# WATER WORKS & SEWERAGE

O WHERE ARE OUR WANDERING
Liquid Chlorine
CONTAINERS???
Please return any empty Liquid Chlorine Containers in your plant . . . promptly.
Although we have sufficient containers on hand . . . their prompt return helps us all keep production rolling smoothly.
Thank you.
IDLE CYLINDERS MEAN IDLE MATERIAL AND LOST PRODUCTION
PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals
1000 WIDENER BUILDING, PHILADELPHIA 7, PA.
NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • CINCINNATI
MINNEAPOLIS • WYANDOTTE • TACOMA


WATER WORKS & SEWERAGE, February, 1945. Volume 92, Number 2. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter June 2, 1931, at the Post Office at Chicago, Ill., under act of March 3, 1879.

# SWING DIFFUSERS

## AERATION FLEXIBILITY
*For*
## VARIABLE OPERATING CONDITIONS

Chicago Wide Band Air Diffusion System with Swing Diffusers at Omaha, Nebr., sewage treatment plant.

## ECONOMICAL INSTALLATION
## MAXIMUM AERATION EFFICIENCY
## ACCESSIBILITY WITHOUT INTERRUPTING OPERATION

**ACCESSIBILITY WITHOUT INTERRUPTION OF OPERATION:** Removal of diffusion tubes for cleaning accomplished without interrupting operation of any aeration unit . . . Swing Diffusers permit simple re-arrangement of diffuser tube spacing to conform with oxygen demand without interrupting operation . . . Raising Swing Diffuser periodically for hosing diffusers can prevent accumulation of organic growths.

**AERATION EFFICIENCY:** Chicago Wide Band Air Diffusion System provides greater oxygen absorption—eliminates center coring—less air for optimum circulation—power economy through reduced hydrostatic head on elevated diffuser tubes.

**ECONOMICAL INSTALLATION** comparable to fixed diffuser systems. Over 150 successful installations.

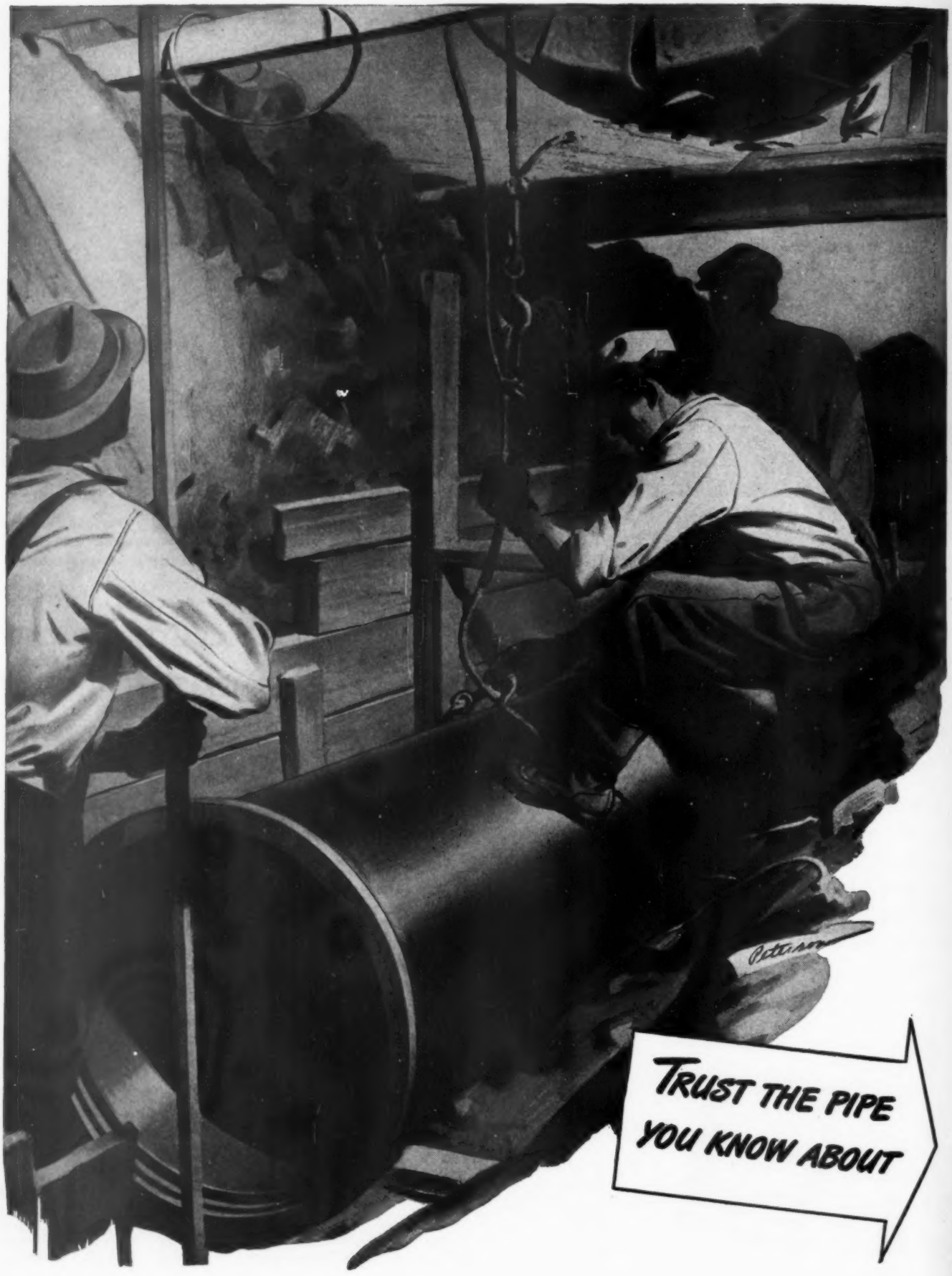
# CHICAGO PUMP COMPANY
## SEWAGE EQUIPMENT DIVISION

**2349 WOLFRAM STREET** — **CHICAGO 18, ILLINOIS**

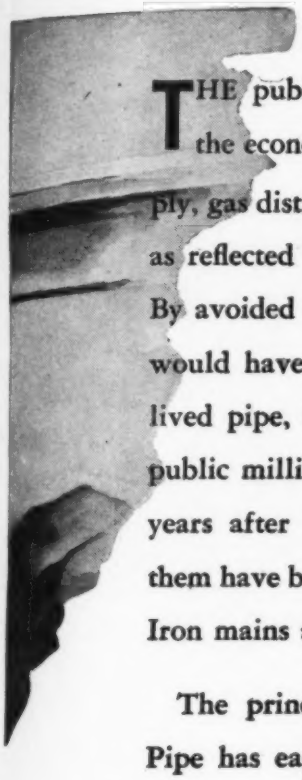
Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

# Why is Cast Iron Pipe known



# as Public Tax Saver No. 1?



THE public has an important stake in the economical operation of water supply, gas distribution and sewerage systems, as reflected in taxes, assessments or rates. By avoided *replacements* of mains, which would have been necessary with shorter-lived pipe, Cast Iron Pipe has saved the public millions of dollars in taxes. Many years after the bonds issued to pay for them have been retired and forgotten, Cast Iron mains are still in service.

The principal reasons why Cast Iron Pipe has earned its reputation as Public Tax Saver No. 1 are as follows:

*A Century or more of useful life as a structure.* The *proved* useful life of Cast Iron Pipe is at least double the *estimated* life of other pipe materials used for underground mains.

*A Century or more of high capacity as a carrier.* Cast Iron Pipe (except in certain locations) assures 100 years of useful life and 100 years of high carrying capacity. In those locations where tuberculating waters are a problem, lined Cast Iron Pipe insures continued high carrying capacity for the life of the pipe.

*Low Maintenance Cost* . . . far below that of any other pressure pipe material which has been in use long enough for the recording of conclusive data.

Address inquiries to Cast Iron Pipe Research Ass'n. Thos. F. Wolfe, Research Engineer, Peoples Gas Bldg., Chicago 3, Ill.

## THE 10 REQUIREMENTS FOR UNDERGROUND MAINS

**LONG LIFE:** The useful life of cast iron pipe is 100 years minimum.

**FLOW CAPACITY:** Under normal conditions, the flow capacity of cast iron pipe remains practically unimpaired for centuries. For the limited areas where active water is encountered, cement-lined cast iron pipe is available. Under such conditions, no other material offers the combined long life and sustained flow capacity of lined cast iron pipe.

**TIGHT JOINTS:** For ordinary pressures, cast iron bell-and-spigot pipe—for high pressures, cast iron mechanical joint pipe—are known to be leak-proof.

**TENSILE STRENGTH:** Standard cast iron pipe ranges from 23,000 to 30,000 pounds per square inch.

**BEAM STRENGTH:** Standard six-inch cast iron pipe bears up under a load of 17,500 pounds and deflects approximately 1½ inches before breaking.

**TOUGHNESS:** Under hydrostatic pressure and the impact of a 50 lb. hammer, ordinary cast iron pipe does not crack until the hammer is dropped four feet (beginning at one foot with one-foot increases).

**INTERNAL PRESSURE:** Standard six-inch cast iron pipe withstands more than 2,500 pounds pressure per square inch.

**EXTERNAL PRESSURE:** A 12-inch section of standard six-inch cast iron pipe withstands a crushing weight of 14,000 pounds.

**IMPERVIOUSNESS:** The walls of cast iron pipe are impervious to leakage, seepage or sweating of water, gas or chemicals under internal pressure tests.

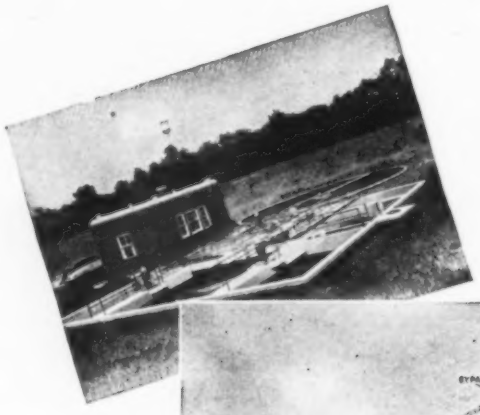
**TAPPING:** Cast iron pipe can be tapped cleanly with strong, tough threads, losing little in structural strength.

**Other pipe materials meet some of these requirements but only cast iron pipe meets them all.**

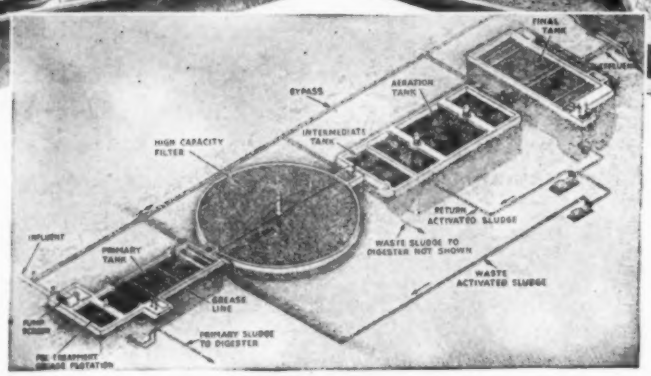
# CAST IRON PIPE SERVES FOR CENTURIES

# American Bio-Activation

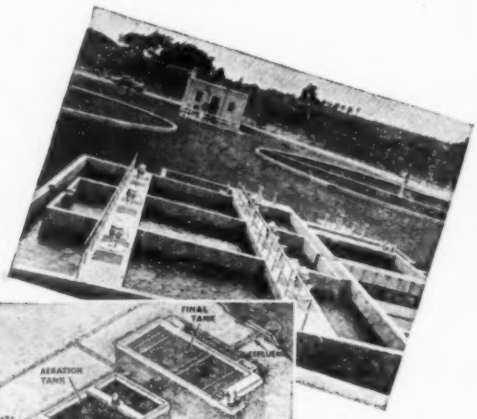
## WASTE TREATMENT



COVINGTON
OHIO




FLOW SHEET



CHILTON
WISCONSIN

***Bio-Activation*** combines the best qualities of both the trickling filter and the activated sludge process to produce a completely stable, nitrified effluent, low in B. O. D. and suspended solids.

### TYPICAL OPERATING RESULTS

| | Domestic, Malt, Brewery and Canning Wastes | |
|---|---|---|
| | 5 BOD | Suspended Solids |
| Raw Waste | 342 | 370 |
| Primary Effluent | 235* | 134 |
| Influent to Filter | 510† | ..... |
| Filter Effluent | 99 | 143 |
| Intermediate Effluent | 58 | 65 |
| % Reduction Filter Influent through Intermediate Effluent | 89.5 | ..... |
| Final Effluent | 13 | 15 |
| % Overall Removal | 97.5 | 96 |

*High Soluble 5 BOD from malt and brewery.
†Pea waste; 600-1200 ppm. 5 BOD, added in primary effluent.

***Blue Print Now! — Send for Bulletin No. 259***

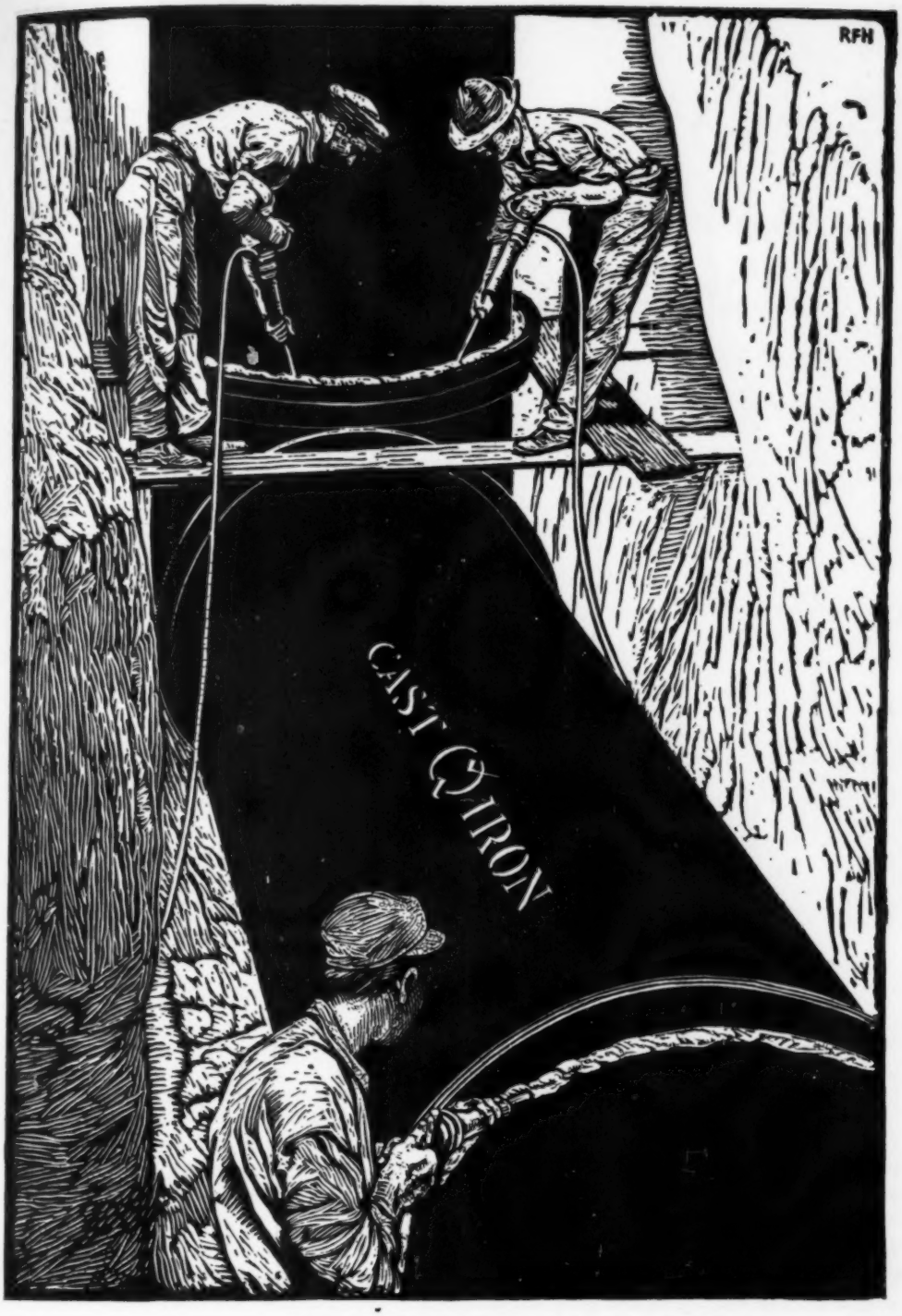
AMERICAN
ESTABLISHED ..... 1868

THE AMERICAN WELL WORKS

*Manufacturers of*

PUMPING · SEWAGE TREATMENT · WATER PURIFICATION EQUIPMENT ·

RESEARCH · ENGINEERS · MANUFACTURERS · *Factory and Laboratories* ··· AURORA, ILLINOIS




Drawn for U. S. Pipe & Foundry Co. by the late R. F. Heinrich

**While the first object of this Company continues to be production for the sinews of war, we are still making cast iron pressure pipe for vital public services such as water supply, gas and sewerage systems. We can supply your pipe requirements with reasonable promptness, subject to governmental regulations.**

**U.S.**
**cast iron**
**PIPE**

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
*Plants and Sales Offices throughout the U. S. A.*

# Everdur withstands chemical wastes at Lederle Laboratories

Everdur Slide Gates, designed and built by Krajewski-Pesant Mfg. Corporation for Lederle Laboratories, Pearl River, N. Y. Installed in 1938, they show practically no corrosion today.

OUTSTANDING as a producer of vaccines, serums, and other biologicals are the Lederle Laboratories of Pearl River, New York. War demand for blood plasma and later for penicillin resulted in tremendous enlargement of both plant and personnel.

Constant cleanliness and uninterrupted sanitation facilities are essential in maintaining the sterility of such products. Here, sewage equipment installed before the war must function efficiently, regardless of the increased volume, varying chemical nature, and fermentation of the wastes handled.

Everdur*—the copper silicon alloy—in the slide gates, screens, weir plates and other mechanical equipment of the sewage system, has again completely solved the problem of corrosion resistance under difficult conditions. From the Lederle Laboratories comes the statement that the Everdur parts serve "—in sewage which probably contains a greater variety of chemicals than is usually encountered in Sewage Treatment Plants, and they show *practically no corrosion yet.* We consider them very excellent for the purpose."

Rust-proof and corrosion resistant, Everdur has the strength of mild steel, and thus makes lightweight construction practicable. Made in nearly all commercial forms. Everdur is readily fabricated and welded. And with all these advantages, it is moderate in cost. 43181

**OTHER APPLICATIONS FOR EVERDUR**

Coarse and Fine Screens, Float Chambers, Swing Gates, Coarse Bar Rack Aprons, Effluent Weirs and Scum Weirs, Structural Scum Baffle Brackets, Troughs, Screen Hoppers, Orifices, Baskets, Anchors, Ladders, Float Gage Chains, Manhole Steps, Guides, Walkways, Bars, Plates, Bolts, Nuts.

*Reg. U. S. Pat. Off.

ANACONDA

**BUY WAR BONDS . . . Buy all you can . . . Keep all you buy.**

**Everdur Metal**

**THE AMERICAN BRASS COMPANY**

*Subsidiary of Anaconda Copper Mining Company*

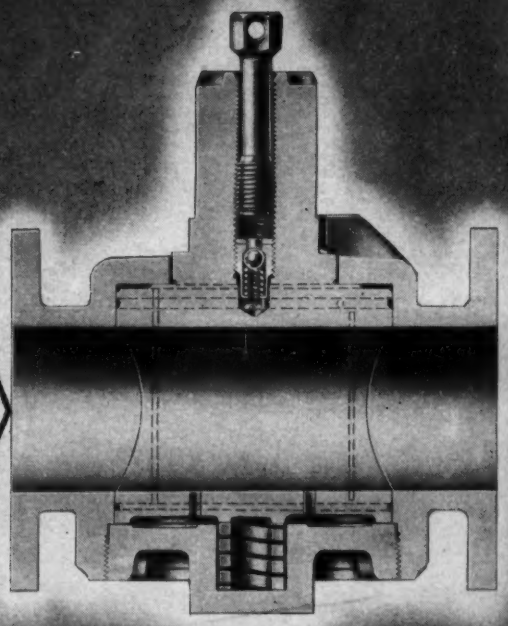
General Offices: Waterbury 88, Connecticut

*In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

# avoid pipe line "log jams" with...

a.c.f.

## Round Port VALVES



# *full pipe area — straight through plugs*

Get rid of pipe line "bottlenecks" *once and for all* with a.c.f. ROUND PORT Full Pipe Area Lubricated Plug Valves! Designed specifically for handling the heaviest, most difficult ladings, the valve when open becomes *an exact continuation of the pipe* — and there can be no velocity, area, direction or cross-section changes of the lading. No abrasive action at the valve — long life.

The a.c.f. ROUND PORT is available in sizes ½" to 8", and is a specialty in the a.c.f. line of full pipe area rectangular port valves. Merely a minimum amount of lubricant is needed when installed and for servicing. In addition, the lubricant acts as a plastic head gasket, hence no auxiliary packing is required. Go-devils, swabs or other cleaning agents that will pass the pipe itself, will pass thru this round port valve. a.c.f. valves may be quickly dismantled and re-assembled. Design problems on both new and replacement work are simplified because the a.c.f. ROUND PORT may be installed *in any position* — and no special tools are needed. Available in wrench, spur, or worm gear types.

Representatives in principal cities carry adequate warehouse stock for quick delivery. Send for Catalog No. 3-W.

**"TAILOR-MADE" FOR SEWAGE LINES**

Liquids bearing solids in suspension such as sewage sludge, and most granulated or similar solids are easily controlled. There are no pockets in which the lading may lodge — power and pumping costs are reduced.

## AMERICAN CAR AND FOUNDRY COMPANY

**Valve Department**

**30 CHURCH STREET, NEW YORK 8, N. Y.**

## *Our Past Claims for the fertilizing value of sewage sludge*

In offering the Royer Sewage Sludge Disintegrator to the sewage works field, we have naturally mentioned the fertilizing values found in sewage sludge.

It is definitely pleasing to us to learn that our claims for the effectiveness of sludge fertilizer have been understatements. The recent writings of A. H. Niles, Supt. Division of Sewage Disposal, Toledo, O., and others, based on long experience in the application of sludge as a fertilizer, have revealed fertilizing values which were not included in our published material until recently.

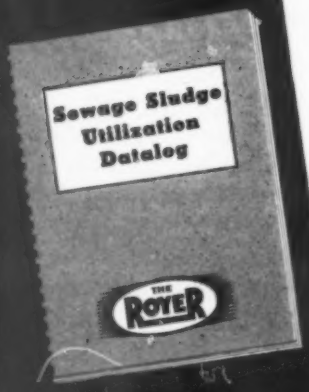
A most important characteristic of sewage sludge is its ability to retain its fertilizing value for an appreciable period; stimulating plant growth throughout the growing season. Most sewage sludges have the residual property of releasing food as the plants need it. The fertilizing elements are not readily leached out under heavy rains, as is the case of chemical salts, because sludge will retain many times its weight and volume in moisture.

The nitrogen fixation bacteria, present in enormous numbers in sewage sludge, are powerfully conductive to soil fertility. These micro-organisms attack and break down straw, dead roots and other organic substances in the soil to a useful state for stimulating plant life. They also have the power to transform the nitrogen in the air to useful compounds that can be assimilated by plants for food.

The sludge cake in your drying beds does not provide these fertilizing values in usable form. But you can readily convert your sludge into effective fertilizer, which you can sell at a substantial profit and at the same time increase America's food production, with a Royer.

The cost of this rugged machine is moderate, and the labor is less than that required to incinerate or bury the sludge. Just shovel the sludge cake into the hopper. The Royer reduces it to pea size, removes trash, aerates and further dries the sludge; discharging an effective, ready-to-use fertilizer, from which hundreds of sewage disposal plants are receiving a handsome income.

Twelve models—electric motor, gasoline engine or belt-to-tractor driven—to meet the needs of every sewage works.




THE ROYER FOUNDRY & MACHINE CO.
KINGSTON, PENNSYLVANIA

WHEN THEY COME BACK HOME, we'll all be there with cheers and shouts . . . but that's not enough. *We must be there with jobs.* For remember, when the parade is over, the men of your community will need plenty of work to carry them over the "war-to-peace conversion" period.

That's why *today* it is up to your municipal officials to start planning the Public Works Programs which will put your local citizens back to work—right in your own home town.

In water supply, sewerage and drainage projects, the Lock Joint Pipe Company is prepared to set up temporary plants in your community. Such a project will employ up to 90% of its workers from your locality . . . help your merchants through the local purchase of a large quantity of supplies and materials . . . and circulate most of the money in your own community.

By specifying Lock Joint Concrete Pipelines, you'll have jobs ready for your engineers, mechanics, laborers and other skilled workers—and you'll be installing pipelines which will give you a century of useful service.

Whether your project is large or small, for the present or future, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

**LOCK JOINT PIPE COMPANY**

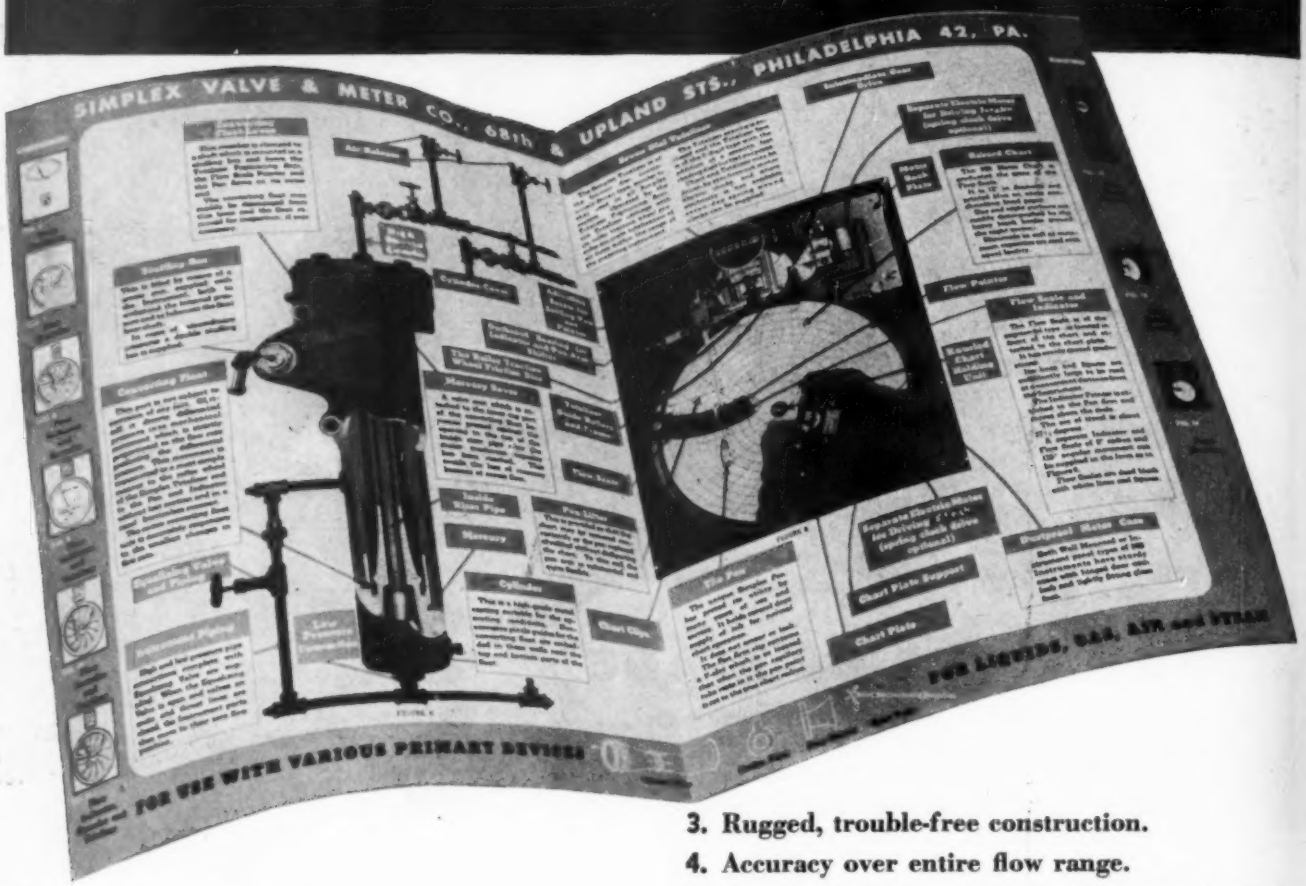
*Established 1905*

**AMPERE, NEW JERSEY**

Denver, Colo. • Chicago, Ill. • Kenilworth, N. J. • Kansas City, Mo. • Rock Island, Ill. Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES — *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

# ACCURATE FLOW MEASUREMENT at LOW COST THE SIMPLEX MS METER


SIMPLEX VALVE & METER CO., 68th & UPLAND STS., PHILADELPHIA 42, PA.
FOR USE WITH VARIOUS PRIMARY DEVICES
FOR LIQUIDS, GAS, AIR and STEAM

This low cost Simplex instrument meets the high standards for accuracy, sensitivity and dependability required in measuring flow rates in water and sewage, as well as in power and process plants.

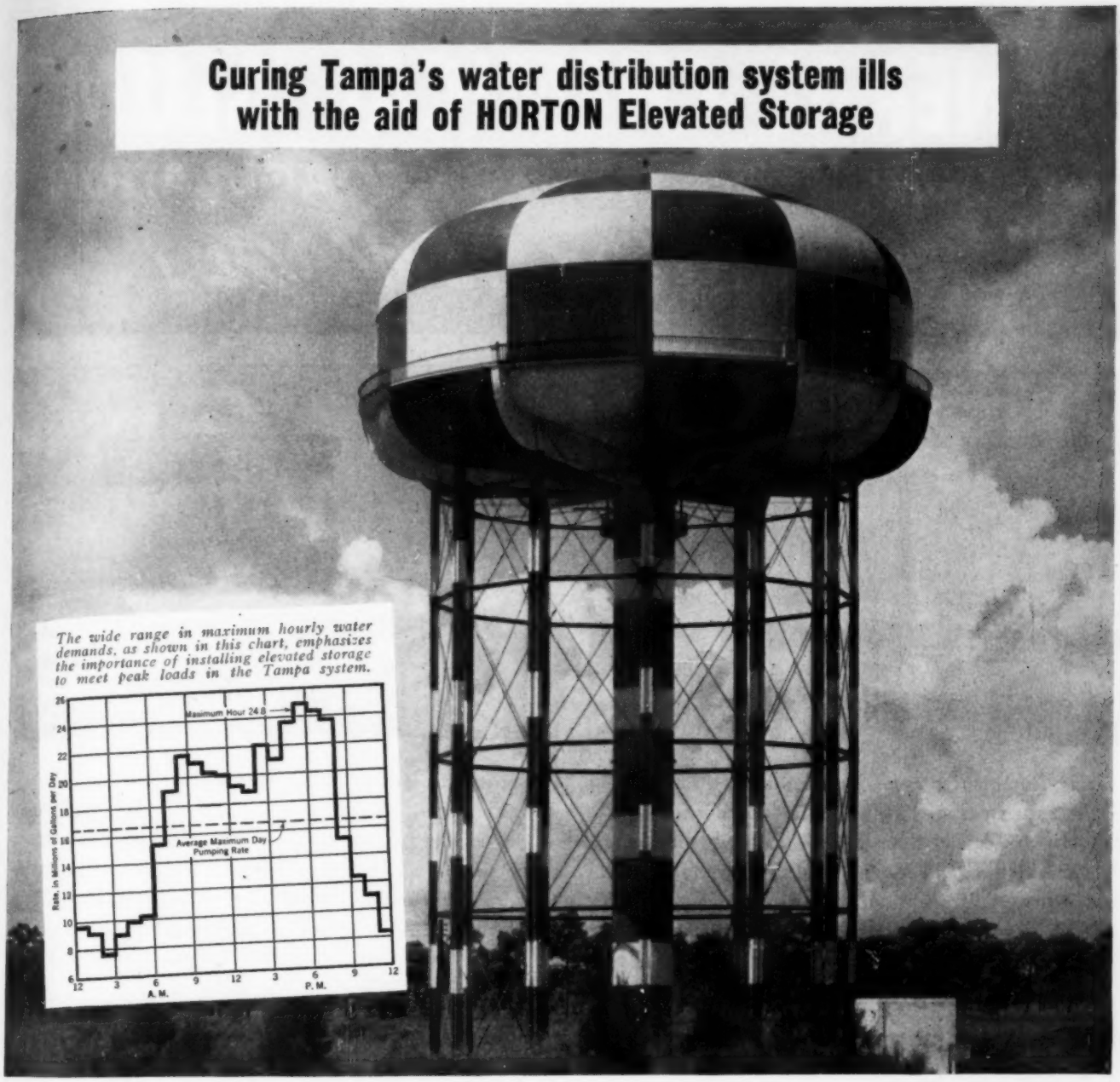
These are some of the advantages of the Simplex MS Meter:

1. Operates efficiently with any suitable primary device.
2. Is installed and maintained economically.
3. Rugged, trouble-free construction.
4. Accuracy over entire flow range.
5. Simplex bell-shaped float which translates the half power of the differential into uniform graduations of chart and dial.
6. Direct reading totalizer of the 7 digit type.

Complete data is now available in Bulletin 350 — straight-forward, factual information with drawings, charts, and test data. Write for your copy today — specify the Simplex MS Meter in tomorrow's planning.

**SIMPLEX VALVE & METER CO.**
**6743 UPLAND STREET, PHILADELPHIA 42, PENNA.**

# Curing Tampa's water distribution system ills with the aid of HORTON Elevated Storage




*The wide range in maximum hourly water demands, as shown in this chart, emphasizes the importance of installing elevated storage to meet peak loads in the Tampa system.*

TO IMPROVE the distribution of water over an enlarged service district, the city of Tampa, Florida, recently completed an extensive modernization program. The addition of trunk mains and the erection of the 1½-million-gal. Horton elevated tank shown above were included in the program.

The tank was located so as to provide ample pressure to the southern extremity of the system which serves the entire metropolitan area containing about 171,000 people. Prior to the modernization program, heavy demands in the Peninsular area resulted in extremely low pressure during periods of peak loads. The new elevated tank has been a lifesaver in relieving peak demands on the pumping station and has proved efficient in equalizing the daily load.

In addition to the new 1½-million-gal. tank, Tampa's municipally-owned and operated water system includes three 500,000-gal. Horton elevated tanks, a 3,500,000-gal. concrete reservoir and a 100,000-gal. elevated tank at Port Tampa City.

*When considering elevated water storage, keep this fact in mind . . . when conditions demand it, our Greenville plant has complete facilities for phosphoric pickling. Ask about our "Phoscote" process.*

## CHICAGO BRIDGE & IRON COMPANY

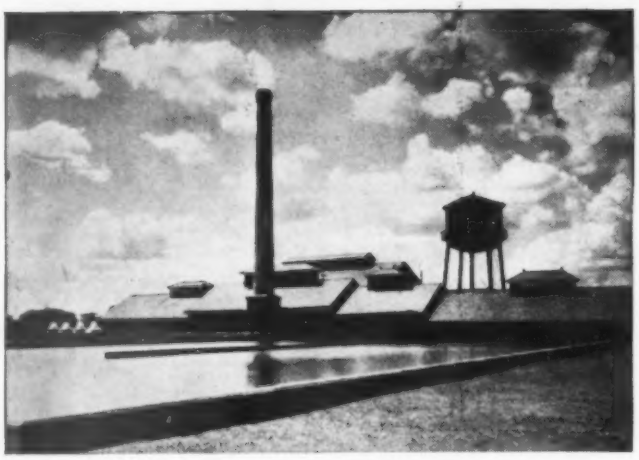
Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th Street

Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Washington 4.....703 Atlantic Bldg.
San Francisco 5.....1083 Rialto Bldg.

In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

# GENERAL CHEMICAL "ALUM"
## . . . EQUALLY EFFICIENT FOR COAGULATION OF *WATER and SEWAGE!*



Today, aluminum sulfate is almost universally accepted by water experts as the best coagulant for the removal of turbidity, color and bacteria from water . . . and General Chemical Aluminum Sulfate is the outstanding choice the nation over. The reason? Operating men have come to rely on its high quality and constant uniformity, knowing that the effectiveness of General Chemical Alum has been "proved in settling basins all over America."

Municipal officials in charge of sewage disposal find that clarity and purity of sewage effluent are also easily obtainable with General Chemical Aluminum Sulfate because of the many reasons noted below. Why not join the majority of American cities that prefer General Chemical Alum—and specify "General" for your requirements?

## ★ FOR WATER WORKS

1. Produces crystal-clear water.
2. Gives better floc formation resulting in longer filter runs.
3. It is a low-cost coagulant.
4. Has no chlorine demand, conserving chlorine exclusively for disinfection.
5. Superior in tests against other coagulants.
6. High in quality, its constant uniformity can be counted upon.
7. Aids in the reduction of tastes and odors.

## ★ FOR SEWAGE PLANTS

1. Clean, easy to handle, dry feeds well, and economical to use.
2. Simple application, requires only low cost feeding apparatus and minimum attention.
3. Clear, colorless effluents are possible.
4. Sludge digests readily.
5. Treated digested sludge dries quickly, with a minimum of odor.
6. Chlorine consumption is cut due to lower demand of clarified sewage.

BASIC CHEMICALS

GENERAL CHEMICAL COMPANY

FOR AMERICAN INDUSTRY

*"Preferred by Most American Cities"*

**GENERAL CHEMICAL COMPANY**

40 RECTOR STREET, NEW YORK 6, N. Y.

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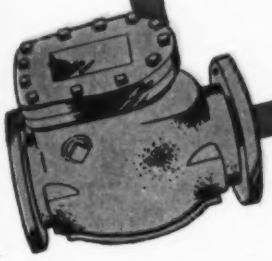
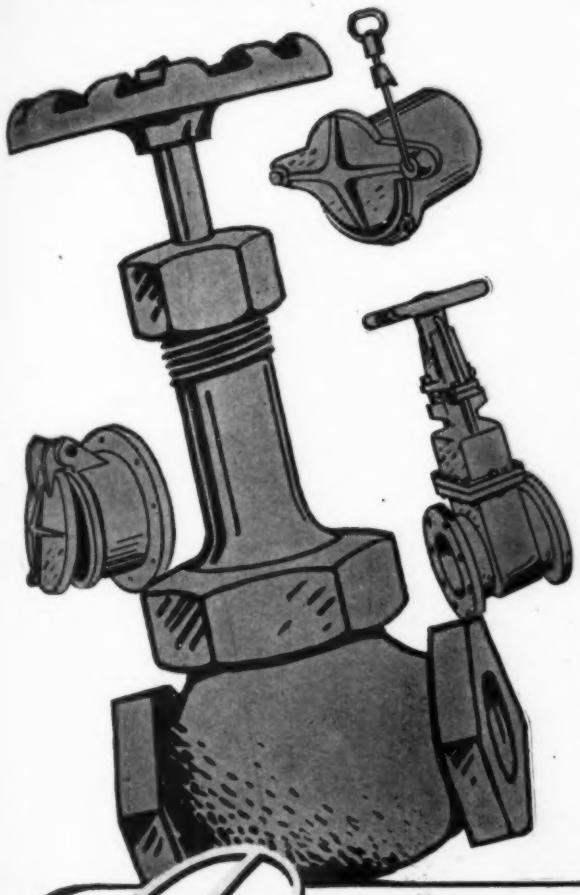
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

# PRODUCT IMPROVEMENT THROUGH DURONZE ALLOYS

## MAKE YOUR OWN TEST WHERE CORROSION IS MOST SEVERE





Pick the toughest job a metal must perform—right in *your own* plant, and test Bridgeport's Duronze alongside the material you are now using. You make the test—you determine the result! The corrosion problems of sewage treatment plants are often intensified by industrial wastes, acids, salts and such gases as hydrogen sulphide, carbon dioxide, ammonia and nitrogen. Sewage equipment, pumps, valves, piping, grinders and paddles, working under such conditions, will stand up longer in service when made from corrosion-resisting Duronze alloys.

Duronze III valve stems, for example, have outlasted other materials many times in certain applications. This alloy is ideal for valve parts, thrust screws, pump parts, bushings, etc. It resists wear because of its low coefficient of friction when in moving contact with steel, bronze and most other materials. Also, Duronze III has exceptional resistance to corrosive liquids and fumes. In rod form and as hot forgings, Duronze III has a tensile strength of more than 85,000 lbs. per square inch; as a sand casting approximately 70,000 lbs. per square inch—values higher than those of ordinary silicon bronzes. These properties mean longer service life, reduced maintenance and replacement costs. Tubing, made from Duronze IV has demonstrated its ability to withstand the corrosive action of water polluted by acid wastes and sewage, hot brine solutions, etc. and should have many useful applications in sewage treatment plants.

Investigate Bridgeport's Duronze engineering alloys with a view to setting up any tests you may wish to make concerning their application to your equipment. In the meantime, write for Bridgeport's 80-page Duronze Manual, just revised and containing latest specifications and technical data on five modern engineering alloys.

"Bridgeport" BRASS

BRIDGEPORT BRASS COMPANY

BRIDGEPORT 2, CONNECTICUT • *Established 1865*

*Duronze Alloys* PRODUCTS OF

**BRIDGEPORT BRASS**

# HOODCHLOR

**THE GUNGA DIN OF THE U. S. A.**

## *High Test Hypochlorite*

### Water, Water Anywhere— Safe and Good to Drink!

When HOODCHLOR is fed into the drinking water supply it quickly destroys and prevents growth of dangerous bacteria. This high test calcium hypochlorite in free-flowing granular form retains its strength for a year or more. Rapid rate of solubility enhances its convenience.

An indication of HOODCHLOR's efficacy and popularity is found in its extensive use by our armed forces all over the world for drinking water of questionable purity.

HOODCHLOR is widely used in this country by municipal and private water systems fo not over 500,000 gallons daily capacity and by larger works for emergency use. It destroys slime and algae in reservoirs, tanks and mains.

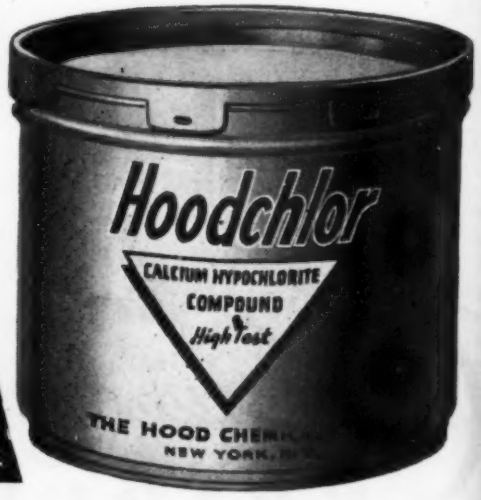
HOODCHLOR is also extensively used in sewage treatment, and for sterilizing swimming pools. Many municipalities keep a supply on hand for emergency use when fires, explosions, floods, or other disasters disrupt the regular supply.

***Send for descriptive folder and price list.***

"Bucket brigade" of Marines, on the beach at Saipan, showing the importance of emergency supply of pure water. Official photo U. S. Marine Corps.

**HOODCHLOR**

is now shipped in convenient resealable steel pails, lined with chlorine resistant lacquer. Net weight 25 pounds. Also packed in 3¾ lb. cans 12 to the case; and 5 lb. cans, 9 to the case.




**HOOD CHEMICAL CO., Inc.**

Executive Offices: 1819 Broadway, New York 23, N. Y.

Factory: Akron, Ohio

HOODCHLOR HIGH TEST CALCIUM HYPOCHLORITE · CAUSTIC SODA
BICARBONATE OF SODA · SODA ASH · CHLORIDE OF LIME

# NEW PUMPS PAY

## MODERN DE LAVAL PUMPS

10% to 15% more efficient than older models

*De Laval single-stage, double-suction water works pump*

**A new pump will frequently pay for itself out of power savings within two years or less, so great have been recent improvements in pump efficiency. Let's consider a typical example:**

**Rate of pumping—3 mgd . . . . . Current cost—2¢ kw./hr.**
**Pumping head ft.—231 ft. . . . . Operation per year—5000 hrs.**
**Assumed motor efficiency . . . . . 88%**

| | YOUR OLD PUMP | A NEW 1944 DE LAVAL |
|---|---|---|
| Pump efficiency | 72% | 83% |
| BHP | 170 | 147 |
| Electric HP | 193 | 167 |

**Power saved 19.4 kw. at 2¢ rate—38.8 cents/hr. Annual saving—5000 hrs. x .3888, or $1,940.00. A new 1944 De Laval heavy duty water works pump, with 150 hp. driving motor and reduced voltage starter, can be supplied for the sum of $2,448. Thus we have:**

***Percentage return on equipment* . . . . . 79½%**
***Time required to repay first cost* . . . . . 15 months**
***Annual saving after liquidation of investment* . . . . . $1,940.00**

**In many cases the cost can be reduced if the existing motors can still be used, making the return much greater. • Now is the time to plan water works improvements. A De Laval representative will be glad to help you work out the details.**

***De Laval Labyrinth wearing rings, sustain high efficiency***

4112

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

# DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON KANSAS CITY • LOS ANGELES • MONTREAL NEW ORLEANS • NEW YORK • PHILADELPHIA PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE TORONTO • TULSA • VANCOUVER • WASHINGTON, D. C. • WINNIPEG

# Here's a prewar picture you'll soon be seeing many times

Manufacturers deliver Aluminum Windows complete, ready and easy to set into place.

## *Aluminum Windows* have withstood the hazards of reduced wartime maintenance programs

The reason so many builders included Aluminum Windows . . . less upkeep . . . has proved out during the war. Windows of Alcoa Aluminum have come through this trying period in fine shape.

Manpower for building maintenance has had to be spread exceedingly thin. To Alcoa, therefore, the fine performance of Aluminum Windows is very gratifying.

The arguments for windows of Alcoa Aluminum are these: Fine appearance, maximum glass area, continued easy opening and closing, no rusting, swelling or rotting. Painting is unnecessary.

ALUMINUM COMPANY OF AMERICA, 1922 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

# *Steady Hands . . .*

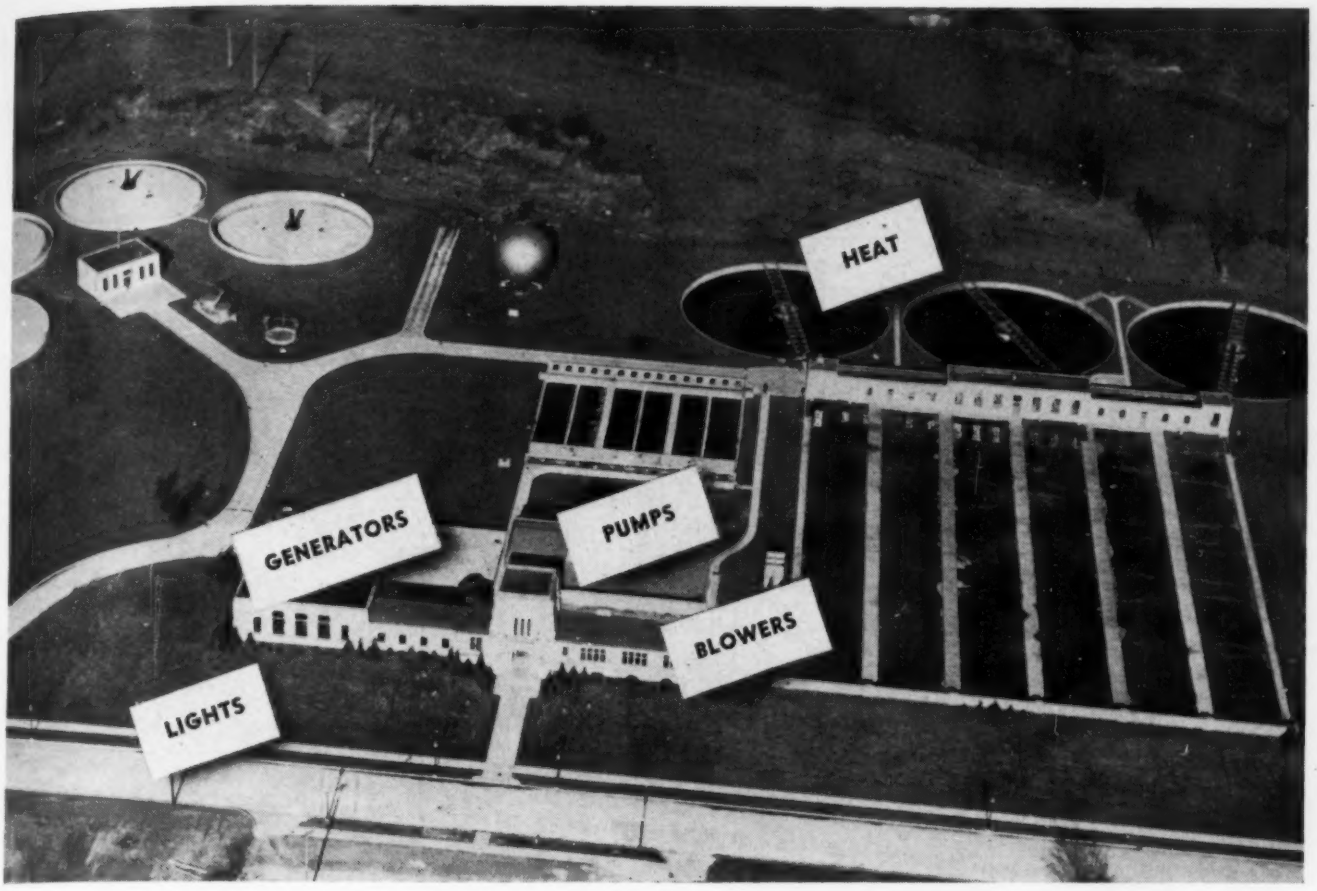
*View of Kettle Room at Niagara Alkali Plant*

NIAGARA has greatly expanded its facilities to meet the enormous war demands for electro-chemical products. Thus as we turn to meet the growing peacetime requirements we remain "steady hands" at the job of producing materials for which Niagara has won an outstanding reputation as a quality house. This is assurance of continued good service and improved quality to those old customers who have relied upon Niagara for many years. And to new customers it means confidence in obtaining the highest standards of quality and the most experienced technical cooperation in the postwar era when electro-chemical products will be in increasing demand.

**Niagara ALKALI COMPANY**

60 EAST 42nd STREET, NEW YORK 17, N. Y.

CAUSTIC POTASH • CAUSTIC SODA • PARADICHLOROBENZENE • CARBONATE OF POTASH • LIQUID CHLORINE




# Power for all needs without Fuel Bills

Whatever your power needs . . . whether for pumps, blowers or generators . . . specify Cooper-Bessemer sludge gas engines for your new sewage treatment plant.

Equipped with these engines, running on sludge gas from your digesters, you need no outside power connections, need pay no power bills or fuel bills. Exhaust engine heat can also be used for heating sludge and buildings.

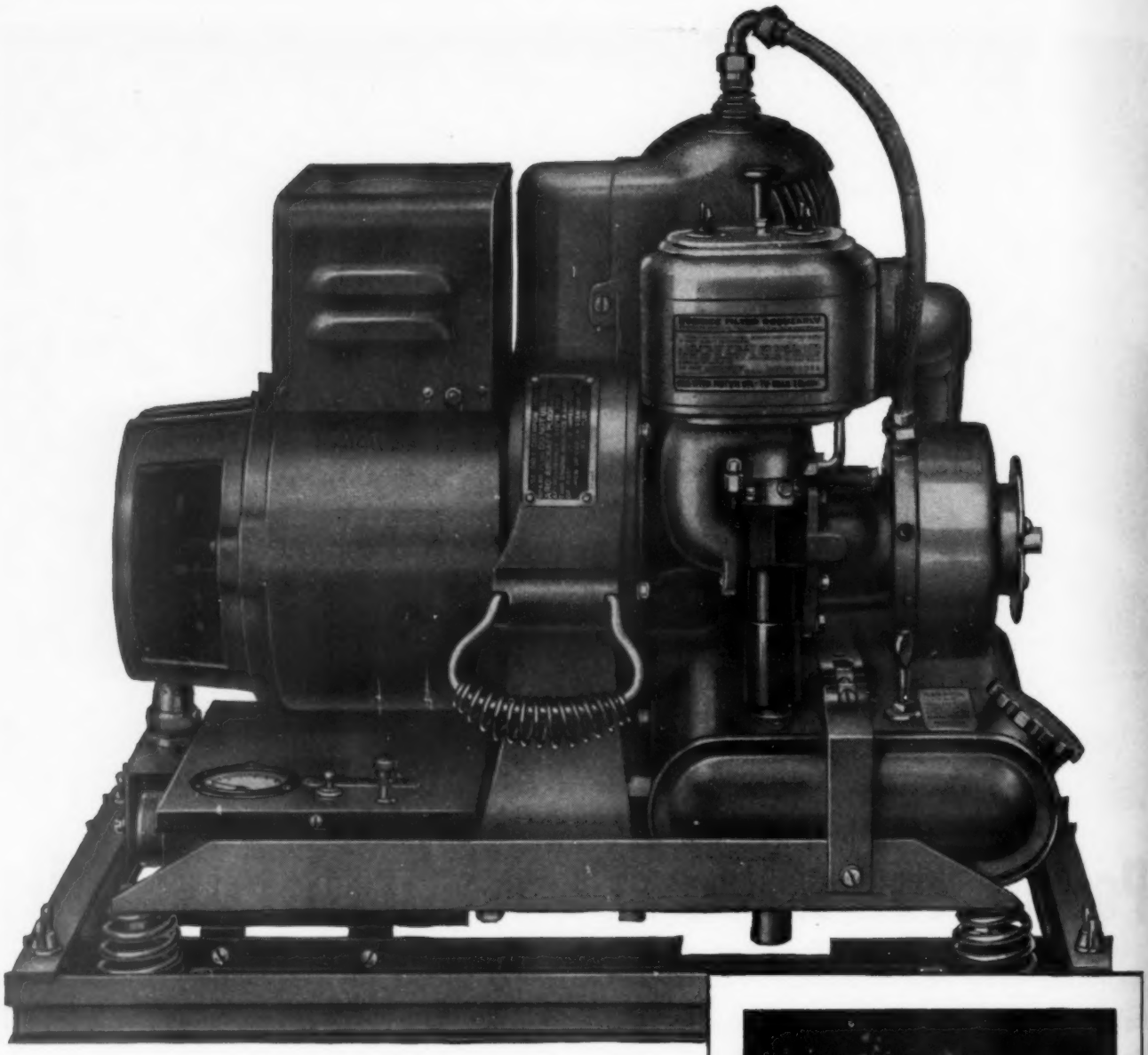
Cooper-Bessemer engines are built in sizes to meet all power requirements from 50 to 1500 horsepower. These engines are known by engineers all over the world for their operating characteristics. They are at work in many of the outstanding sewage treatment plants in this country and are first choice of operating men in the gas industry.

Cooper-Bessemer has been building dependable engines for more than 111 years, and every feature is carefully designed for long life and trouble-free operation. Specify Cooper-Bessemer engines for your new or enlarged sewage treatment plant, as an economy to taxpayers and a service to the generations to come.

THE Cooper-Bessemer CORPORATION

Mt. Vernon, Ohio • Grove City, Pa.

New York Washington Tulsa Dallas St. Louis Houston Los Angeles Seattle Shreveport



# It has to work alone and like it

No and's, if's or but's about it, a Homelite Portable Generator, installed in a plane or a tank is in no position to receive nurse-maid attention. It's usually crammed into some hot, tight corner where it is practically impossible to service it.

Which means just one thing . . . a Homelite Generator with its built-in gasoline engine has to work and stand up under the toughest kind of usage . . . hours on end . . . without receiving any attention or service. To meet demands like this . . . born of war . . . Homelite engineers have developed a higher powered, lighter-weight and, above all, a more dependable gasoline-engine-driven generator . . . a compact, portable Homelite that will meet and pass the performance requirements of any peace-time job.

**HOMELITE CORPORATION**
PORT CHESTER, NEW YORK

**FOR YOUR PEACE-TIME JOBS**

**The new Homelite Portable Generators that you will use after the war for operating brilliant floodlights or electric tools will work better in winter and summer. They will be more dependable even under the toughest operating conditions. They will work longer hours without attention or service . . . and will be more rugged and powerful than ever before.**

## Portable Pumps - Generators - Blowers

# Calgon does 4 things—and does them well

**1**

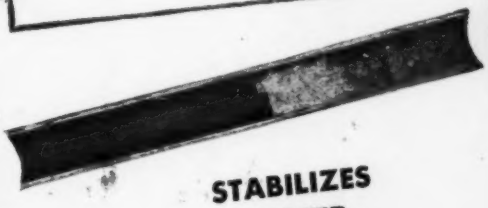
**CONTROLS CORROSION**
from soft water

**2**

**ELIMINATES "RED WATER"**
either from corrosion or from dissolved iron in well water

**3**

**PREVENTS SCALE**
from hard high-bicarbonate water



**4**

**STABILIZES WATER**
after lime-soda softening and prevents scale deposits

MANY water works men find it difficult to believe that one product can be highly effective in solving all four of the problems shown above. This is quite natural because, in the past, solving the scale problem often introduced corrosion –and safety from corrosion could usually be obtained only by forming scale.

Calgon works differently and it may be necessary for you to get a fresh view point before you can see how Calgon can solve each of these problems. Here's how it works:

**In soft corrosive water** Calgon maintains a thin protective film over pipe metal and metal oxides throughout the system and reduces the attack of oxygen so effectively that corrosion ceases to be a serious problem and "red water" is eliminated.

**In "Red water"** resulting from the precipitation of dissolved iron from well water, Calgon has the property of inhibiting precipitation. Because there is no precipitation of dissolved iron, "Red water" doesn't show up at the consumer's tap.

**In hard, high-bicarbonate water** Calgon prevents precipitation of calcium carbonate scale to the extremities of the line. It eliminates scale troubles in pipe lines, valves, meters and hot water heaters.

**In lime-soda softened water** Calgon, added after the softening process, stabilizes the water and prevents precipitation of calcium carbonate in all parts of the system.

For any of these treatments, the amount of Calgon* needed is extremely small—only 1 to 5 ppm., depending on individual plant conditions. Write for full information.

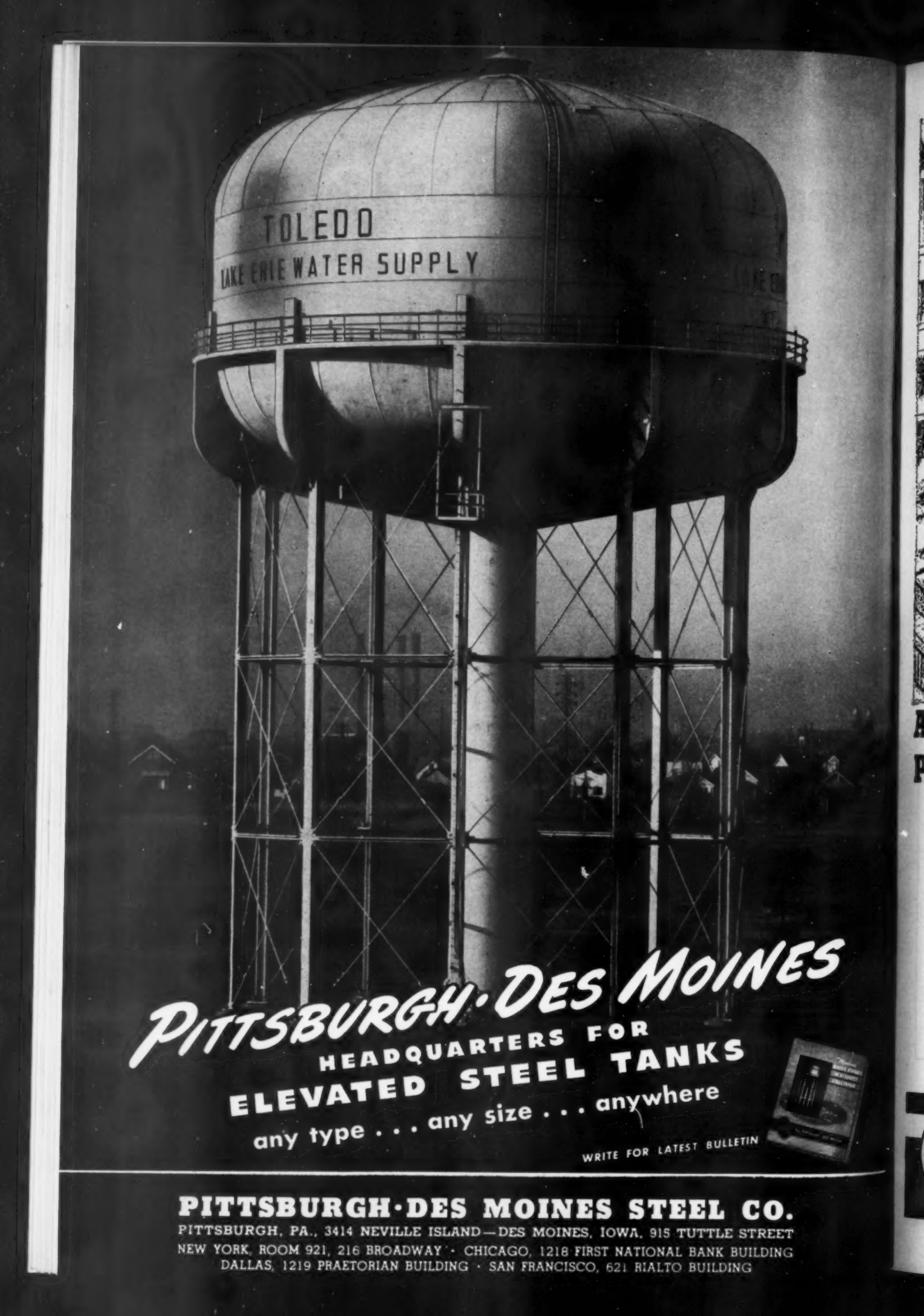
*Calgon is the registered trade-mark of Calgon, Inc., for its glassy sodium phosphate products.

HAGAN
HALL
BUROMIN
CALGON

**calgon, inc.**

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH, PA.




# PITTSBURGH·DES MOINES

## HEADQUARTERS FOR ELEVATED STEEL TANKS

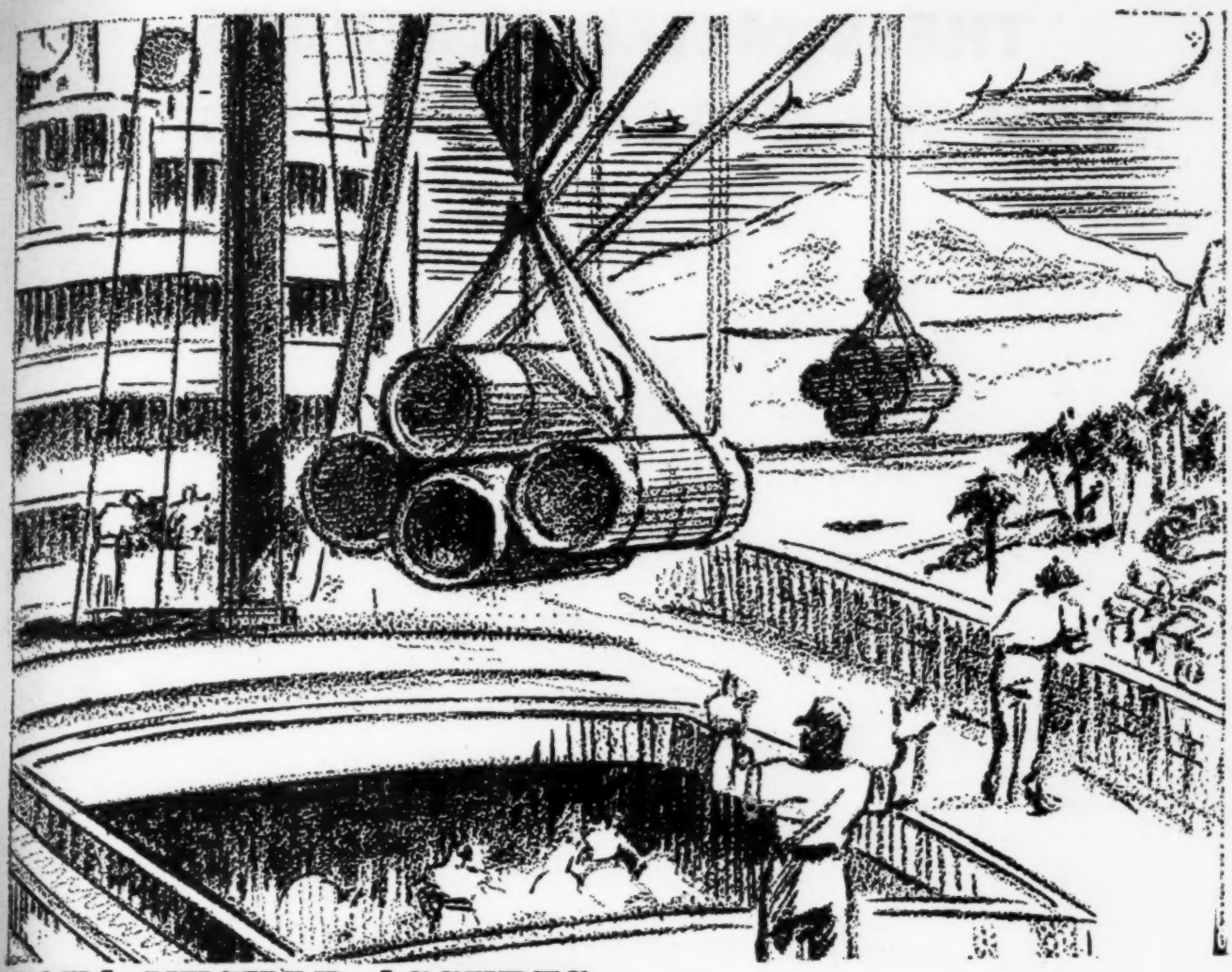
any type . . . any size . . . anywhere

WRITE FOR LATEST BULLETIN



**PITTSBURGH·DES MOINES STEEL CO.**

PITTSBURGH, PA., 3414 NEVILLE ISLAND—DES MOINES, IOWA, 915 TUTTLE STREET
NEW YORK, ROOM 921, 216 BROADWAY · CHICAGO, 1218 FIRST NATIONAL BANK BUILDING
DALLAS, 1219 PRAETORIAN BUILDING · SAN FRANCISCO, 621 RIALTO BUILDING



# AQUA NUCHAR ASSURES PALATABLE WATER ON EVERY FIGHTING FRONT!

From the South Pacific to Mainville, U. S. A., Aqua Nuchar Activated Carbon makes water clear, palatable . . . pleasing to the taste.

A Little Aqua Nuchar goes a long way, because Aqua Nuchar purifies by *ad*sorption. Each particle of Aqua Nuchar Activated Carbon is riddled with tiny pockets that trap algae and other taste-forming bodies, thus giving your community palatable water.

Unpalatable water is a particular threat at this time of year with winter's thaws and high water. A sudden change in temperature can mean an equally rapid transition in your water supply. Consequently, waterworks engineers all over the country should keep a supply of Aqua Nuchar Activated Carbon at hand to cope with unexpected situations.

For crystal-clear water, give your community the same purification protection that Uncle Sam gives G. I. Joe. Although Aqua Nuchar is servicing on fronts all over the world, there is an ample supply in this country for *your* community.

At strategic points throughout the United States you'll find stocks of Aqua Nuchar — the activated carbon that does a big job of purification . . . by *ad*sorption.

**BLUEPRINT NOW!**

But above all, remember there is a war yet to be won. Maintain equipment to assure operation at 100% efficiency.

**INDUSTRIAL CHEMICAL SALES**

DIVISION WEST VIRGINIA PULP & PAPER COMPANY

230 PARK AVENUE, NEW YORK 17, N.Y. — 35 E. WACKER DRIVE, CHICAGO 1, ILLINOIS — 748 PUBLIC LEDGER BLDG., PHILADELPHIA 6, PA. — 844 LEADER BLDG., CLEVELAND 14, OHIO

# THESE METER FEATURES WON THE BIGGEST CONTRACTS!

## *3 Reasons Why* WORTHINGTON-GAMON *Meters Were Specified*

The largest water meter contracts ever awarded in the United States named "Watch Dog" meters.

This choice is due to these facts:

1. Worthington-Gamon has the longest experience of any water meter manufacturer—a fact which suggests superior performance over the longest life.
2. Manufacturing controls established not just for meters, but for a broad line of Worthington equipment used by municipalities, provide greater assurance of low-cost maintenance.
3. Constantly-improved Worthington-Gamon meter designs have developed an unusual ability to measure accurately even the smallest quantities of water.

No other water meter manufacturer maintains as extensive service facilities as Worthington-Gamon—24 district offices in 24 leading cities. Worthington water meter technicians and Worthington Research Laboratories will help you work out a plan for better, lower-cost metering.

*Subsidiary of*

**WORTHINGTON PUMP AND MACHINERY CORPORATION**

Power Plant Equipment • Turbines & Turbo-Generator Sets • Condensers, Heaters, Ejectors • Water Purification Equipment • Pumps, Stationary and Portable Compressors • Air Conditioning & Refrigerating Equipment • Power Transmission Equipment • Construction Machinery, Equipment for Mines • Locomotive Feedwater Heaters • Welding Positioning Equipment • Liquid Meters

**WORTHINGTON-GAMON METER COMPANY**

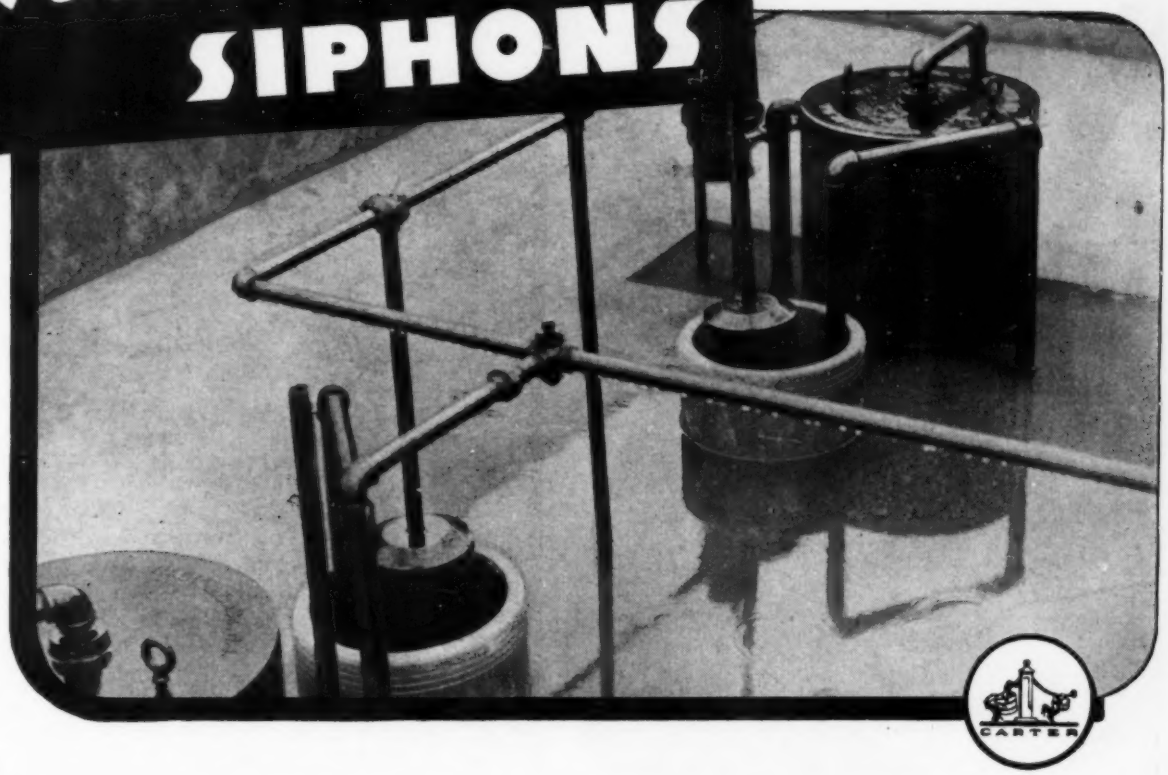
282-296 South Street, Newark, New Jersey

WG 4-5

The Meter Specified in the Largest Contracts Ever Awarded in the U. S.

"Watchdog" models . . . made in standard capacities from 20 G P M up; frostproof or split case in household sizes. All parts interchangeable with your present meters of our manufacture. Write for Bulletin.

# Alternating SIPHONS




Fully automatic, designed for trouble-free operation, the CARTER siphon gives quick uniform alternate cycle distribution where a high degree of treatment is required.

Analysis on secondary treatment has shown that sand filter beds when dosed alternately by automatic siphons give results equal to, and in many cases superior to other methods, regardless of cost.

This economically efficient proven method is most certainly worthy of your consideration in that post war plant.

Whether your dosing requirements are 280 or 10,000 gallons per minute, in the single, double or plural type, we are ready to assist you. Our engineering and testing facilities are always available for technical aid to our customers. No obligation of course.

*Write for Bulletin No. 4312*

•

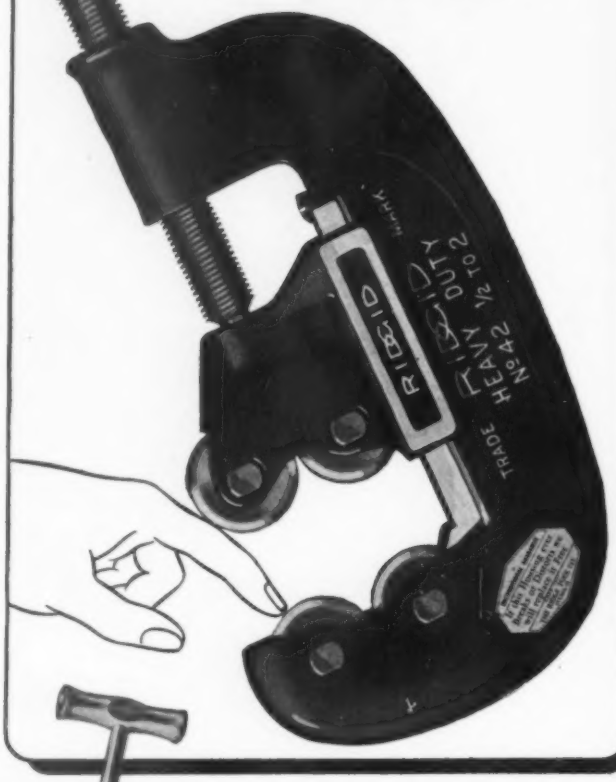
**RALPH B. CARTER COMPANY**

*MAIN OFFICE* - - - - - - - HACKENSACK, N. J.
*NEW YORK OFFICE* - 55 PARK PL., NEW YORK 7, N. Y.

**CARTER also MANUFACTURES**
DIAPHRAGM PUMPS • SLOW MIXERS • FLOCERS
FLASH MIXERS • CLARIFIERS • PADDLE AERATORS
SLUDGE MIXERS • DIGESTERS • ROTARY
DISTRIBUTORS • CONTRACTOR'S PUMPS

**RALPH B. CARTER COMPANY**
*AUTOMATIC ALTERNATING SIPHONS*

# Fast, easy pipe cuts with this 4-wheel RIDGID




## Cuts cleanly with a quarter turn

● In tight places it's a wonder. Short handle — and 4-wheels mean swift clean easy cuts, which you'll enjoy also where there's plenty of room to work. A beautifully balanced husky cutter that doesn't fool around, the stout frame making the special heat-treated steel wheels always cut true. Two sizes: No. 42, ½" to 2"; No. 44, 2½" to 4". Buy it for better cutting and long service — at your Supply House.

*Regular* RIDGID *Cutter has fast cutting thin-blade wheels.*

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.

THIS PUMP HAS WON ITS
*Service Ribbon, too!*

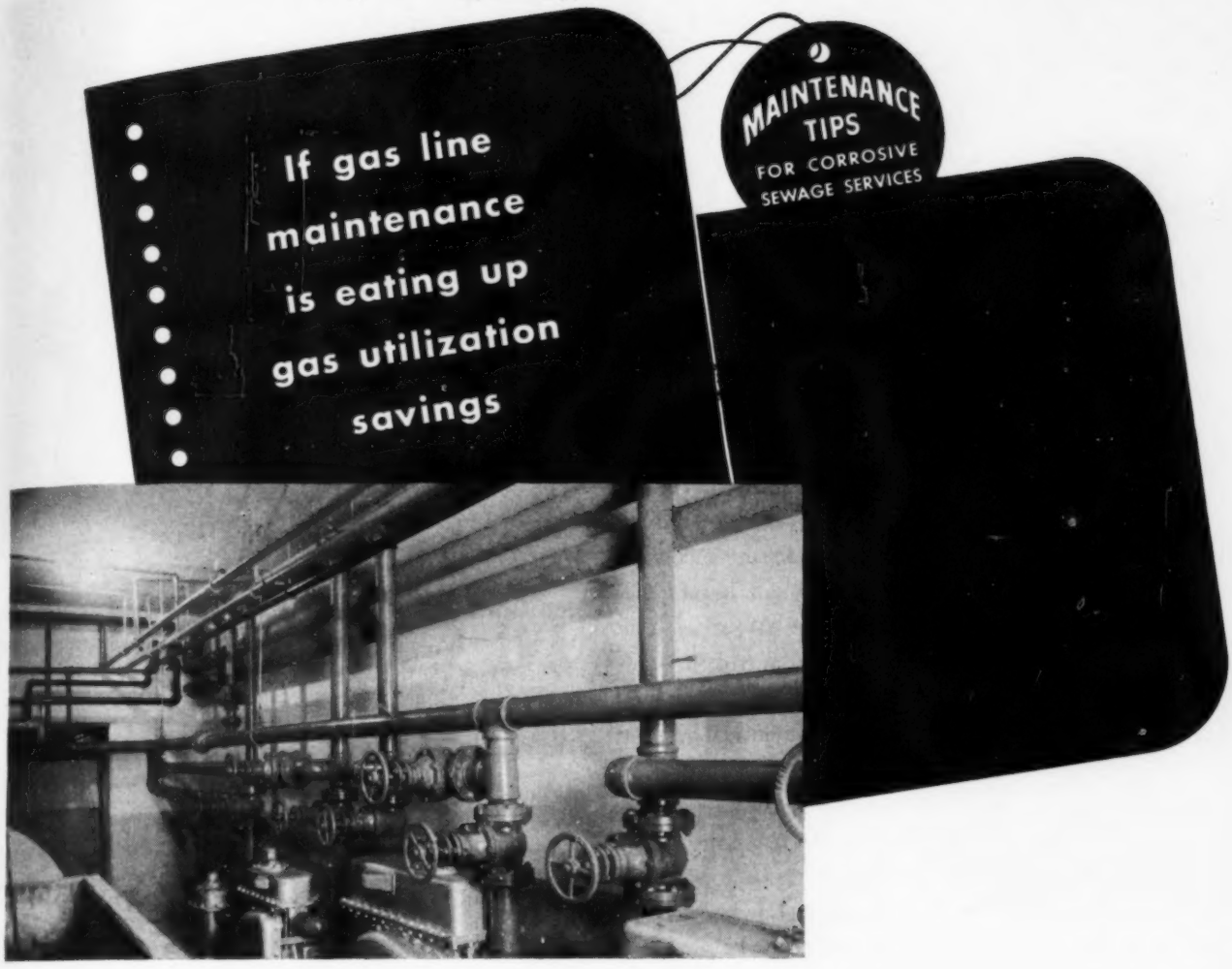
NEXT to food, nothing on the battlefront is as refreshing as a cup of cool, pure water. Thousands of Peerless Pumps have gone to the battlefronts. Wells are hastily drilled so that our boys will not be exposed to the hazards of bacteria or poisoned water. The simplicity of Peerless Hi-Lift and Turbine Pumps, their compactness, dependability and ease of installation make them first choice on the battlelines. Here at home Peerless Pumps have also won their *Service Ribbons.* Right through wartime they have given unfailing service.

Many Peerless Pumps have operated 24 hours daily for years without shutdown, without a penny spent for repairs. In considering your plans for a better water supply, we invite you to share Peerless experience and success.

Peerless engineering is *precision* engineering that permits *closer tolerances* which eliminate the customary vibration to an unusual degree. Thus, wear and tear are reduced; repair bills consequently are the lowest. Top-flight quality underground is a Peerless tradition.

*Capacities . . . 10 to 220,000 gallons per minute! Designers of the famous "Water Buffalo."*

PEERLESS PUMPS
PEERLESS PUMP DIVISION
Food Machinery Corporation
TURBINE
HI-LIFT
HYDRO-FOIL
301 W. Ave. 26, Los Angeles 31, Calif. • 1250 Camden Ave. S.W., Canton 6, Ohio • Other Factories: San Jose 5, Fresno 16, Calif.




Using gas from digesting sludge for heating, power generation or as gas engine fuel has a lot of economy possibilities—but it's well to watch out that the savings aren't cancelled by excessive repair bills. The gas commonly consists of about 60% methane, 20 to 30% carbon dioxide, and small quantities of other gases, including hydrogen sulfide. When the sulfur and carbon compounds are absorbed by moisture, they become aggressive acids, and unless the piping is able to resist such attack, replacements are bound to come too soon.

No commonly available metal is immune to this attack, but the experience of many users, over periods of years, indicates that wrought iron lasts longer, and that its cost per year of service is lower. Its durability in this service is generally recognized by designers and operating men, as is shown by its widespread use. Recent installations have been made in Illinois, Michigan, Ohio, Wisconsin, Pennsylvania and Indiana—to mention a few.

The resistance of wrought iron to corrosive attack is not confined to the surface, but goes "all the way through," and is due to the unique two-component structure of the material. Tiny fibers of glass-like silicate slag are threaded through the body of high-purity iron. When corrosion strikes these fibers, it is halted and deflected. As a result, there is a slow and gradual reduction of the wall section, instead of the rapid penetration that occurs with ordinary materials. The fibers also help anchor the initial protective film, and this shields the underlying metal just as a scab protects a wound.

If you are encountering difficulties with any of your gas lines, because of premature failures, you will find it will pay you to investigate the service possibilities of wrought iron. You will find some sound and helpful information on the problems involved in gas lines, and reports on how engineers are solving them, in our bulletin, "Wrought Iron in Sewage Treatment and Disposal Installations." If you do not have this book, we will be glad to send you a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

HOOKER CHEMICALS

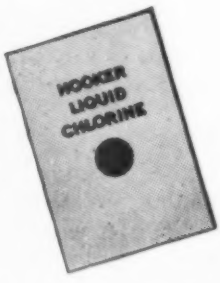
## *Are you using Hooker Chlorine for Sewage Treatment?*

Of increasing interest to sanitary engineers, water works and sewage officials is the use of chlorine in sewage treatment. The use of chlorine to reduce B. O. D. and retard putrefaction in the receiving water course, and to disinfect effluent before discharge, is receiving a great deal of attention. The stabilization of raw sewage, odor control, prevention of filter ponding and increasing filter bed efficiency, improvement of sedimentation, and sludge digestion are other operations employing chlorine.

Hooker chlorine has been the choice in water works and sewage treatment plants because of its consistently uniform high quality. Hooker's Technical Staff, too, is at your service in helping you solve any problems involving the use of chlorine and the other Hooker chemicals.

### SEND FOR THIS HOOKER CHLORINE BOOKLET

Have you requested your copies of the Hooker "Liquid Chlorine Booklet"? It contains helpful information on this chemical, physical and chemical properties, its uses, and, of particular value to new employees, precautions for handling, storing and transporting. Copies are free when requested on your letterhead.



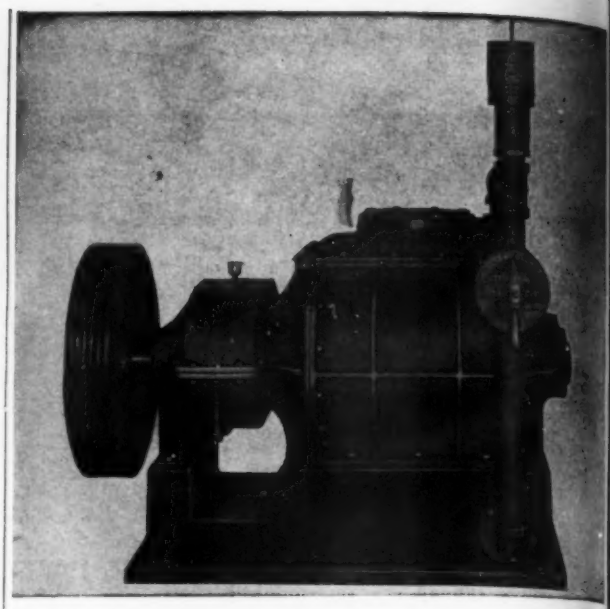

HOOKER CHEMICALS

**HOOKER ELECTROCHEMICAL COMPANY**
Buffalo Ave. & Ward St.
Niagara Falls, N. Y.

New York, N. Y. Wilmington, Calif. Tacoma, Wash.

*Caustic Soda* *Chlorine* *Bleaching Powder* *Ferric Chloride*





# MORE AIR

**for your sewage disposal plant**

# AT LESS COST

*because*

Pottstown Rotary Positive Displacement Blowers require less power than other types . . . are built extra-sturdy for extra service . . . have no reciprocating, sliding or other friction wearing parts that require adjustment maintenance or replacement expense . . . and have proven their notably long life and trouble-free operation in sewage plants all over the country.

*WRITE FOR COMPLETE INFORMATION*

**ALLEN BILLMYRE COMPANY**
449 Fayette Avenue • Mamaroneck, N.Y.

**POTTSTOWN**
ROTARY POSITIVE DISPLACEMENT
**BLOWERS**

*When Blueprinting for Tomorrow—*

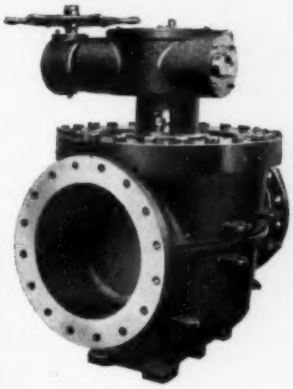
*particularly, the handling and controlling of Water and Sewage—*

*plan to use* SMITH AXIAL-FLOW PUMPS *and* FREE FLOW ROTOVALVES

## The Automatically Adjustable Blade Impeller Axial Flow PUMP

DESIGNED to meet water pumping and controlling needs. Adopted by leading engineers and officials in modern waterworks, sanitation plants, and flood control systems. Available with either fixed or automatically adjustable blades—which vary the discharge by changing their pitch while the pump is in operation—particularly, advantageous for low varying heads and high volume requirements. Write for Bulletin 142.

## The Free Flow ROTOVALVE



A CONE-type plug valve with full circular opening, thus assuring free flow and losses no greater than in a pipe of equal length and diameter and with operating mechanism that will lift, rotate and reseat the valve plug. Adaptable for hydraulic, motor, manual, or pneumatic operation. A one-type, multiple-purpose valve for all water and sewage uses obtainable by merely changing the control mechanism, or the actuating means. Full details in Bulletin 140. Send for it!

***Enjoy the full benefits of efficiency in operation tomorrow by planning wisely, today. Profit by our 70 Years of Experience in Hydraulics! Put your problems up to us!***

**S. MORGAN SMITH Co.**

YORK, PENNA. U.S.A.

*Manual de*

# INGENIERIA SANITARIA

# 1945

# *CULTIVATE this ACTIVE EXPORT MARKET*

**A campaign is being waged throughout South and Central America against waterborne diseases. Water suply systems are being improved, studies are being made and plans are being drawn for better sanitary engineering.**

**Particular attention is being given to areas along strategic highways; around airports and shiping centers; and in the vicinity of defense bases. These activities are part of a campaign against typhoid fever and other diseases spread by waterborne parasites.**

**From Peru, from Colombia, from Mexico and Paraguay and all other Latin American countries come reports of plants under construction or plans in the making. Manufacturers of supplies and equipment to serve the water and sewerage fields, will find this export market worth cultivating.**

# *NEW Specialized Coverage*

**Water Works Superintendents**
**Consulting Engineers**
**Managers of Utility Companies**
**Equipment Distributors**

Manual de Ingenieria Sanitaria is designed to serve as a practical Reference and Data book for the men in Latin America charged with the problems of water supply and sanitation.

Printed in Spanish, it is a handbook of informative data and a buyers' guide. Published annually it gives to the advertisers year-around reader interest and offers access to the greatest potential market in the world today.

**Sanitary Engineers**
**Chemists**
**Public Officials**
**Civil Engineers and Contractors**

The first annual edition will be released in January 1945. It will be comparable to the English edition of the Reference and Data issue of Water Works and Sewerage, which is used by superintendents, operators, engineers and public officials throughout the United States and many other countries.

The Managing Editor of Ingenieria Sanitaria spent the summer of 1944 in South America making studies and reports of this field.

***2,000 Guaranteed Circulation.***
***Schedule Space Now — Write for Details.***

*Manual de*
**INGENIERIA SANITARIA**
GILLETTE PUBLISHING COMPANY • 330 S. WELLS ST., CHICAGO 6
Publishers of WATER WORKS & SEWERAGE · ROADS & STREETS · CAMINOS Y CALLES · POWERS' CATALOG
CLEVELAND NEW YORK LOS ANGELES

# DIAMOND LIQUID CHLORINE

**For dependable water purification**

**always uniformly high in quality!**

Standardize on Diamond Liquid Chlorine for uniformity, dependability and highest quality. Shipped in cylinders, multi-unit and single unit tank cars, according to the requirements of individual users.

**DIAMOND ALKALI CO.**
**PITTSBURGH, PA.**
**AND EVERYWHERE**

*Automatic & Proportional*

**CHEM-O-FEEDER**

**Automatic and Proportional Hydraulically Operated High Pressure Chem-O-Feeder controlled by standard water meter to operate against pressures from 60 to 200 lbs. per sq. inch.**

It takes a skilled operator to coax the ooom-pah out of a bass horn, but %Proportioneers% Automatic and Proportional Chem-O-Feeder automatically injects *just* the right amount of treating chemical at *just* the right time. The Chem-O-Feeder starts, varies and stops dosage of the chemical as the water comes on, fluctuates and tapers off. By keeping strict pace with changing flow rate it prevents dangerous undertreatment or the disagreeable taste resulting from wasteful overtreatment.

*Send for Bulletin SAN-1*

# % PROPORTIONEERS, INC. %

**9N CODDING ST., PROVIDENCE, R. I.**

# WATER WORKS & SEWERAGE

PUBLICATION OFFICE
330 South Wells Street, Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor


## COMING!

**e Story of Meters for Naugatuck**

related by a water utility manager faced with tching" a peace-time ample supply so that industry might secure sufficient water with- having to develop independent supplies and valuable production while so doing. Complete eration of consumers appealed as the simplest most common-sense method of converting er waste into water for war-production use. successful the plan and program was and how r rates were developed by the "cut and try" ess, so that consumers paid no more for water ice than when on the flat rate basis, while they ample water and industry could be supplied what had previously been wasted water, is by—

WM. H. MOODY, President,
The Naugatuck Water Co., Naugatuck, Conn.

**hodic Protection of**
**age Works Equipment**

this issue is the second of a series of articles thodic protection of submerged metal surfaces corrosion and electrolysis prevention process. ur March issue an article describing the prac- application of this electrochemical process to rtant units of a sewage treatment plant, with rly demonstrated evidence of the value of this paratively untried method of checking corrosion ewage treatment units. This feature article is contribution of—

A. B. KOZMA, Supt.,
t Sewage Treatment Works, Rutherford, N. J.

**Tank of Novel Design**

volving a combination of pre-stressed steel cement mortar applied by the gunniting process roduce a thin walled light weight, bottle tight economical dome covered water storage ground is described by—

I. M. GLACE,
Consulting Engineer of Harrisburg, Pa.

**mical Treatment of Soapy Waste Waters**

fers an excellent means of handling wastes laundries, scouring establishments, and syn- ic rubber plants employing soap solutions. Ex- mental data on the application of calcium and nesium salts to the treatment of such wastes been obtained and reported by—

HARRY W. GEHM, Tech. Advisor,
Nat. Council for Stream Improvement.

**ing an Oil Problem**

the story of the effects of an oil bearing in- rial waste on sewage plant operation and e digestion. How this waste of oil is now reclaimed at the industrial plant and kept of the sewer is told by—

I. O LACY, Supt,
Sewage Treatment, Lockport, N. Y.

**lacing a Six Inch Valve**
**in a Sludge Digester**

no simple matter when the tank can not be ed. How this job was ingeniously accom- ed without emptying the digester at Ft. Totten. , is explained and illustrated by—

ROBERT C. URBAN, San. Engr.,
Corps of Engineers, Ft. Totten, N. Y.

**at Is an Oolith?"**

you would know watch for the article on the rtant subject of biological growths on the ior of water mains and their relationship to g, tuberculation, "red-water," and the "black- r" of anaerobasis. In this article we are in- ed to the oolith of the crenothrpx by—

"Doc" CARL WILSON,
Water Technologist, Los Angeles, Calif.

**inating Cross-Connections in Los Angeles**

resented no small undertaking when consider- he installation of 10,000 vacuum breakers, rais- 21,000 inlets to provide air-gap protection. ing 2,000 direct connections to sewers and lling 2,300 back-flow prevention mechanical es on pressure lines. How all of this was ac- lished, with advice on what to do and what to do and illustrations of "before and after" ctions is told by—

RAY. F. GOUDEY, Chief San. Engr.,
Dept. of Water & Power, Los Angeles, Calif.

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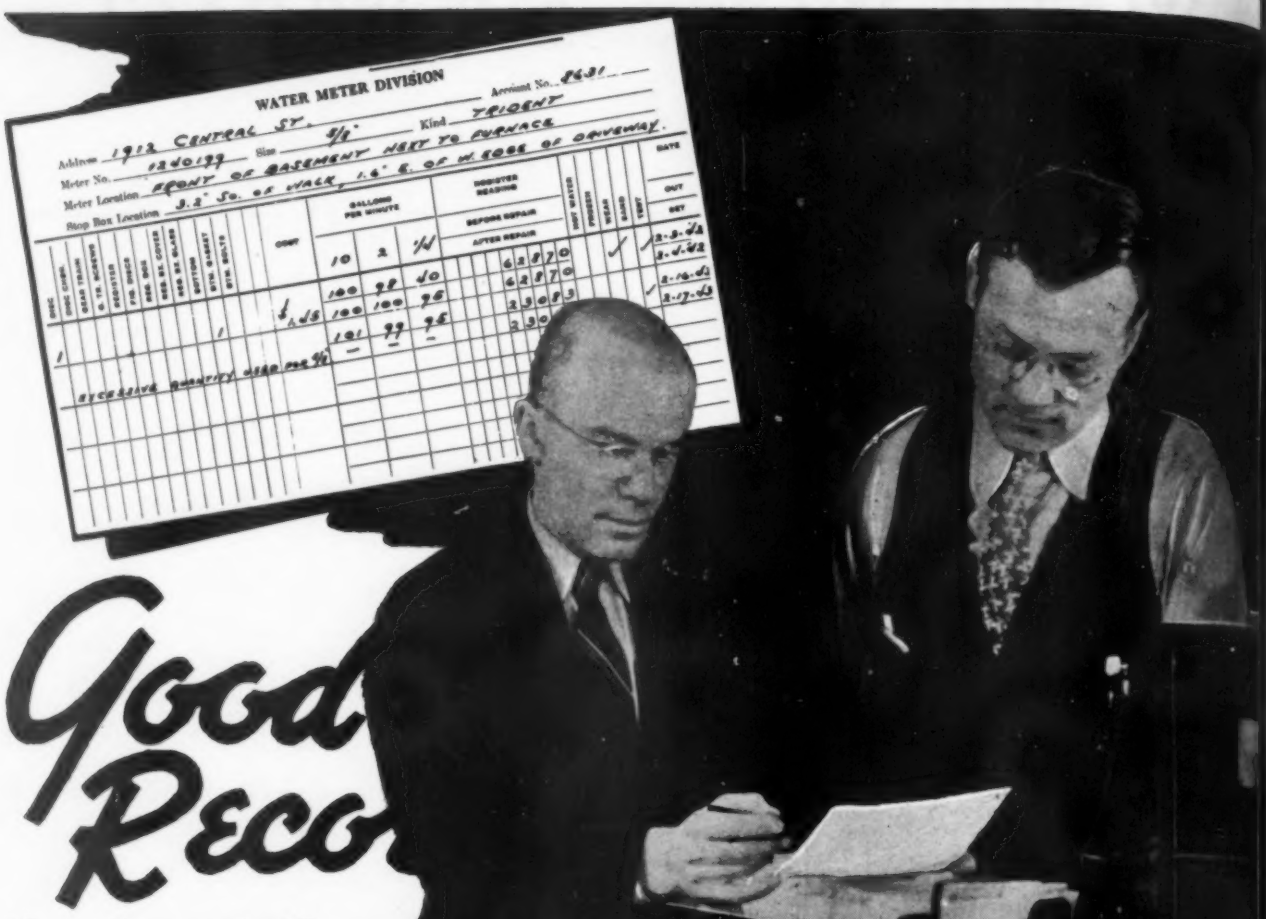


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WATER WORKS & SEWERAGE

VOL. 92, No. 2 *A Gillette Publication* FEBRUARY, 1945

# DEVELOPMENTS OF THE YEAR IN SEWERAGE AND INDUSTRIAL WASTES

By ALBERT E. BERRY
Director, Sanitary Engineering Division,
ONTARIO DEPARTMENT OF HEALTH,
TORONTO, CAN.

ONCE again the war effort has signally actuated the year's developments in sewage and industrial waste treatment. This period has been marked not by the construction of new plants or major changes in existing ones, but rather by the plans which have been in progress for post-war construction. These have been fostered with a good deal of energy and with gratifying success.

New municipal construction, except in urgent cases, has been at a standstill, so that all efforts could be directed to the prosecution of the war. The demand for sewerage works to serve military establishments, which in recent years was a major item, had already been pretty well satisfied. But these factors have not meant stagnation in the sewerage field. On the contrary, sewage plant operators have been faced with many problems requiring skill and ingenuity.

The Author
President FSWA

Research in waste handling has proceeded as rapidly as time and personnel would permit, and under the circumstances those engaged in this have done exceedingly well. Results and operating data derived from plants functioning under such a variety of conditions, have produced information which will prove highly valuable in the expansion to come, when present-day restrictions on supplies and equipment have disappeared. Current difficulties continue to encourage and to demonstrate the abilities of the operator and administrator to attain higher objectives.

## *Post-War Planning*

The impetus for post-war planning has been focused from a number of directions, and has resulted from a hopeful realization that the final phase of the war was approaching. Hence it

**Walla Walla, Wash.—A 0.5 mgd. Two-Stage Biofiltration Plant**
*(Preceded by a Dorrco Vacuator—Sludge digested in a Dorr Multidigestor)*

was essential to have, instead of mere visionary objectives, something in the form of detailed plans which might be put under construction on short notice. Various organizations and groups have furthered this by their active support, and the public has been cognizant of the need for preparing for the future.

The Committee on Water and Sewage Works Development, representing four associations, has made a signal contribution to post-war planning. Sewerage planning has come to the fore, and the significance of this activity has been expressed statistically in the report that, out of all public works planning on the drawing boards or completed at the end of the year, sewage works in the U.S. made up over 14 per cent, as compared with an average of 4 per cent over the last 20 years for total public works construction.

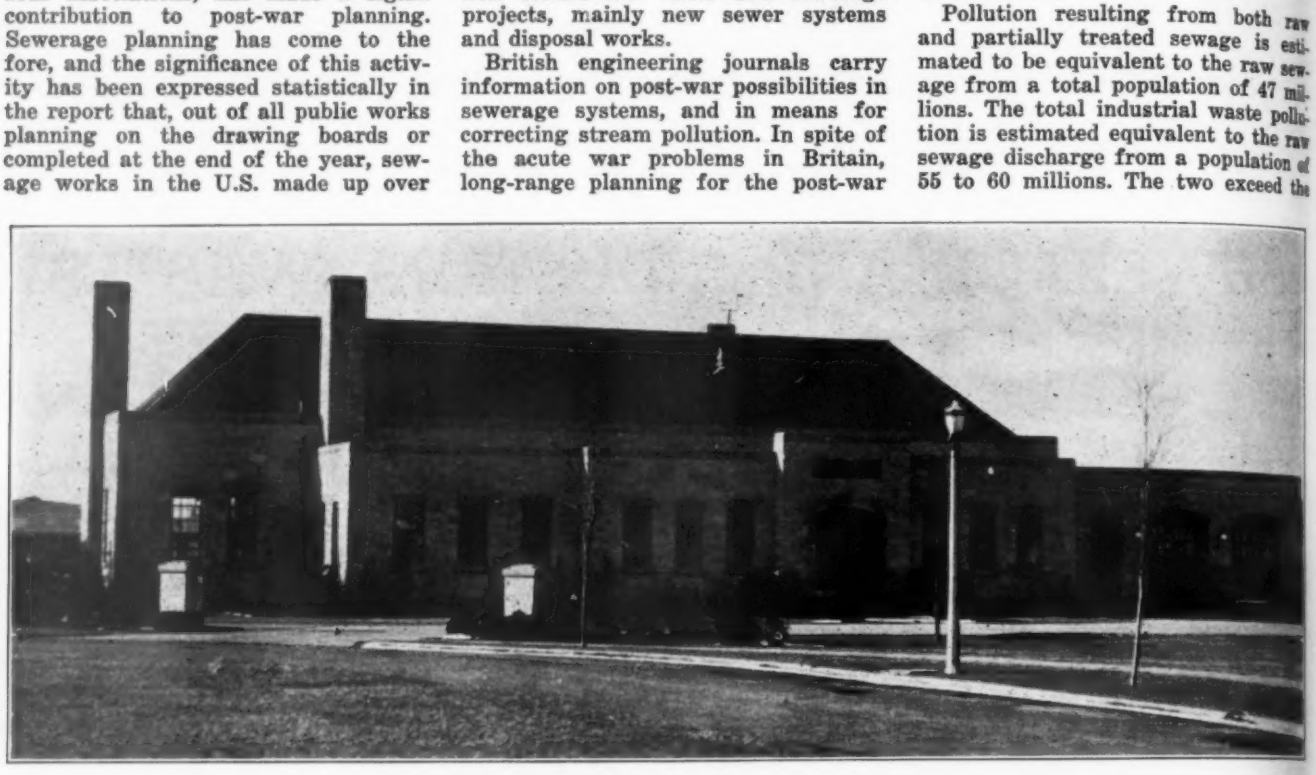
The committee has taken a broad view of post-war planning, in advocating that the municipalities themselves should prepare to finance these works rather than assume that federal or other agencies will give support. It has been felt that any policy which relies on other aids was good for neither party over a period of time. Exceptions, of course, may be recognized.

Support for post-war planning has been found in large measure in the various States. Two measures have been prominent; one permitted the setting-up of post-war reserve funds, and the other provided state financial assistance for preparing plans of these projects.

The State of New York may be cited as an example of effective planning in which these various measures have been employed. A Post-War Public Works Planning Commission has been given authority to assist municipalities to the extent of paying 50 per cent of the cost of preparing plans, specifications and estimates. The commission may pay a maximum of 2 per cent of the estimated construction cost for the design, with the understanding that the municipality contributes a like amount. By the middle of 1944 applications approved or pending for sewerage projects were over $33½ million.

Post-war planning for sewerage works is proceeding apace in Canada, England and elsewhere as well as in the United States. The program for Ontario has been estimated at 40 million dollars for water and sewerage projects, mainly new sewer systems and disposal works.

British engineering journals carry information on post-war possibilities in sewerage systems, and in means for correcting stream pollution. In spite of the acute war problems in Britain, long-range planning for the post-war period has not been lacking. Both the Institute of Sewage Purification and the Institution of Sanitary Engineers have advocated that sewerage and sewage purification services should be on a regional basis. Legislation empowering local authorities to form these joint boards has been in existence for some time, but has not been widely adopted.



**Water Supply Protection Plant, Kenosha, Wis.**
*(Bothered by Copper in the Digesters)*

## *Post-War Sewerage Needs*

Post-war planning can be effective only when the need for such projects has been clearly defined. The U.S. Public Health Service has prepared an inventory of public sewerage needs, showing a figure of $2,255,150,000 worth of new or additional sewers and sewage treatment facilities. This total is broken down as follows: Total number of communities involved 16,752; new sewer systems and extensions required in 13,271 communities will represent a cost of $656,190,000; intercepting sewers as part of additional treatment works for existing sewer systems in 2,804 places are estimated to cost $559,160,000; while sewage and industrial waste treatment needed in 10,522 locations will call for an outlay of $1,049,800,000.

An analysis of these figures has been made on a population group basis; one being 5000 and over, another from 1000 to 5000, and the third under 1000. Ninety-six per cent of the places in the first group are served by public sanitary systems in contrast with 18 per cent in the lowest group. Thus it is seen that the smaller centers are the places where the greatest need for sewers exists.

Pollution resulting from both raw and partially treated sewage is estimated to be equivalent to the raw sewage from a total population of 47 millions. The total industrial waste pollution is estimated equivalent to the raw sewage discharge from a population of 55 to 60 millions. The two exceed the raw sewage contributed from 100 million people. This water pollution has been estimated to impose an economic burden of one dollar per capita annually for 75 per cent of the entire population in the United States, or roughly $100 million a year. Thus the need for more sewage treatment is obvious.

Some comparison of these needs in the United States with those in Canada may be of interest. Here, also, it is evident that the major need for sewerage systems is in the smaller population groups. Much of the sewage from sewered municipalities is discharged either raw or partially treated. In the Province of Ontario the estimated post-war cost for new sewer systems and for sewage treatment is approximately $30 million. At present, 59 per cent of the total population is provided with sewers, and the sewage is treated for less than one third of this population.

## *Major Works Planned*

Post-war planning of the year may be judged both by the number of projects under development, and by the magnitude of some of these. While the smaller works may be equally significant to their respective communities,

or the costs may be as difficult to meet, and the results of equal local importance, it is the major treatment plants that are conspicuous. To these we look for trends in design, construction and other advances in the science, and the development of any year in sewerage works must note what is done in these major projects. Through these there may be reflected what is going on in the smaller units, too numerous to cite separately.

The plans of New York City for sewage treatment and intercepting sewers are of special interest. At present, 40 per cent of the city's sewage is being treated. A program, involving $82,000,000 worth of construction, is actively under design, and when completed will take care of 85 per cent of the flow and comprise seven additional plants to treat 705 mgd. of sewage. The complete plan for the city calls for 17 sewage treatment works. Six plants will provide complete treatment by the activated sludge process; the other eleven either plain sedimentation, with or without chlorination, or by "modified sewage aeration." This latter method developed by the city, while similar to the activated sludge process, is much cheaper. The results are superior to chemical precipitation. The Rockaway plant, with an initial capacity of 15 mgd., is to be this type.

Construction drawings are complete for the Hunts Point plant. This 120 mgd. activated sludge plant will cost $9,000,000. The Ward's Island plant of activated sludge will be increased by 200 mgd.

The Owls Head project, with a designed capacity of 160 mgd., will be of the modified sewage aeration process, as will also be the Newtown Creek plant of 140 mgd.

New York's plans call for digestion of practically all sludge, and the recovery of digester gases for power production. Most of the sludge will be disposed of at sea, but some will be recovered for use as fertilizer.

Another interesting major project (estimated cost $21 million) is the high rate activated sludge plant for the City of Los Angeles. Its function will be to clean up the excessive pollution along the beaches.

Project plans are complete for an activated sludge plant for Nassau County on Long Island, with a capacity of 54 mgd.

Philadelphia's post-war sewerage program is estimated to cost $38,000,000, and at present a study is proceeding on rates of charge to finance this construction and its operation.

In the Hampton Roads area in Virginia, construction is nearing completion for intercepting sewers, sewage pumping stations and force mains. This is a war requirement project.

Portland's voters authorized a $12 million bond issue, to proceed with intercepting sewers and a treatment plant involving sedimentation and sludge digestion, to take care of the pollution in the Williamette River.

The Chicago Sanitary District has extensive plans for enlargement and completion of its sewage treatment works and the construction of intercepting sewers at a cost of over $30 million. Included is an increase in the capacity of the Southwest activated sludge plant to 900 mgd.

During the year work has been proceeding at Toronto, Ontario, on the first stage of a sewage treatment plant designed for a flow of 84 mgd. (Imp.). War restrictions have made progress slow, but work has been proceeding for the past year.

An example of a sewage treatment plant which has been completed during the year to serve military establishments, and which will be of special benefit to the municipality in the post-war period, is found at Norman, Okla. The plant has been completed for primary treatment now to handle the wastes from war areas as well as the city; secondary treatment will be added later.

A major disposal problem at Miami has been reported on, with three different methods being considered.

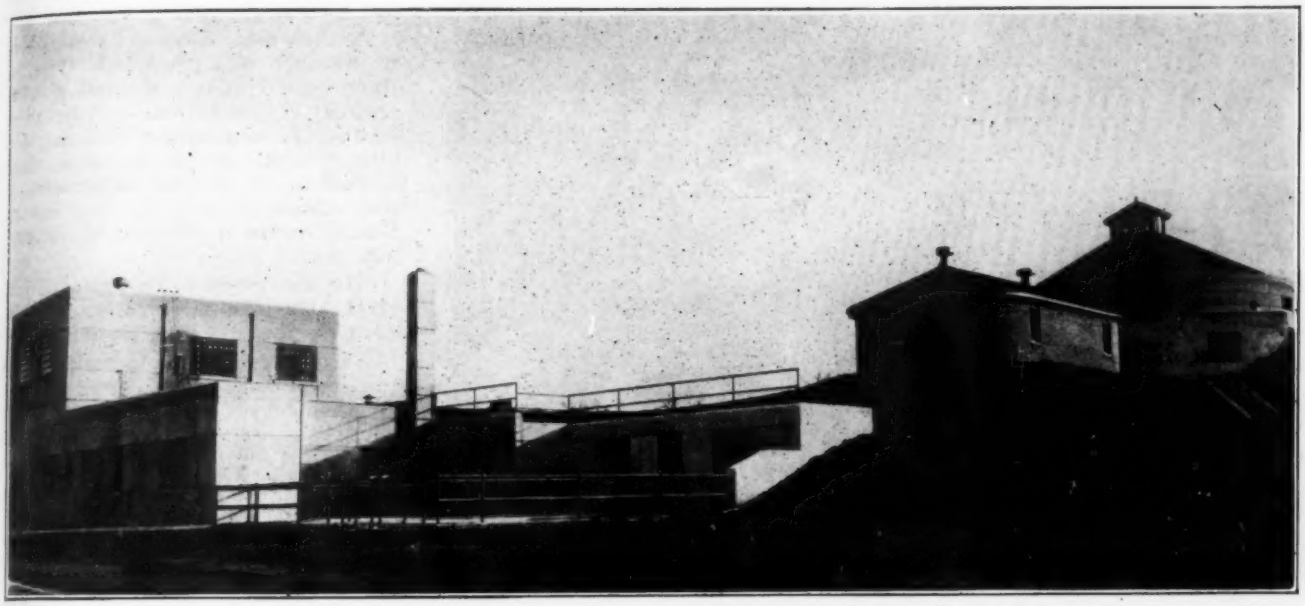
Studies at Akron, Ohio, of the Imhoff tank and sprinkling filter plant have resulted in the conclusion that repairs to this plant to handle 30 mgd. and the construction of a new activated sludge plant of 37.5 mgd., with incineration of digested sludge, should be carried out.

### *The Industrial Waste Problem*

The disposal of industrial wastes has been a crucial problem in recent years, and 1944 has been no exception. Wastes from industry, upon which information has been forthcoming, included special materials resulting from war-time activities, as well as wastes which have been present for some time but the volume of which has been increased to the point where it has created new problems for solution.

In the course of the year, studies and activity have been devoted to many different wastes, but some have been especially conspicuous, and for the probable reason that they are most troublesome and most frequent. Greases and oils have ranked high in the list. Paper wastes have likewise received much attention, and the industry has taken a lead in the solution of the problem. Acid-iron wastes have continued to be onerous. Food wastes have been intensified, and those peculiar to war manufacturing plants have called for a solution in many places. All in all, industrial wastes have been prominent during the year, and they are likely to be a factor for some time to come.

Much has been written about grease, because of its widespread occurrence and stepped-up production during the



**Aero-Filter Sewage Treatment Plant at Detroit Lakes, Minn.**

war. It has created an intensive problem, in spite of the necessity for wartime saving as far as possible. Grease is a by-product from private homes, restaurants and industries. Two objectives have been foremost in its control; one to exclude it as far as possible from sewers, and the other to remove it at the proper stage and in the most effective manner before it can create difficulty.

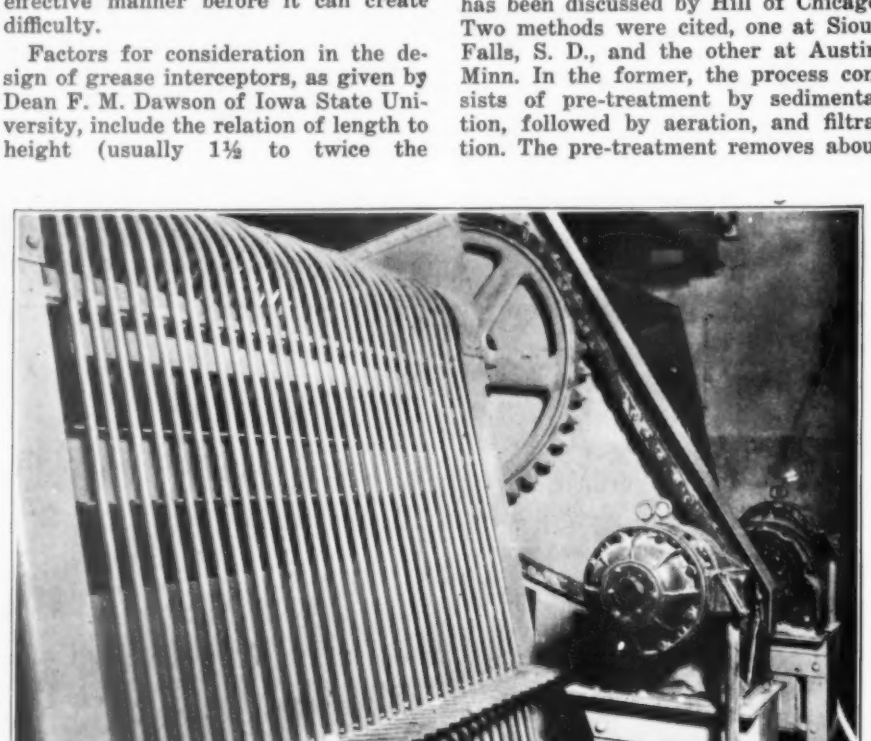
Factors for consideration in the design of grease interceptors, as given by Dean F. M. Dawson of Iowa State University, include the relation of length to height (usually 1½ to twice the height), particle size of the grease globules (greater than 0.05 cm. or it will not rise), rate of flow (maximum velocity 0.1 ft. per min.) and turbulence (factor of 0.5 to be used).

The exclusion of greases and oils from sewers is not required by municipal ordinance to any great extent, but in Baltimore such legislation has been in use for some time. The collection of oil and grease by the city since 1927 has cost $32,013.75 for which 4,287,714 gal. has been recovered.

Grease has been a persistent problem in army camps, and intensive efforts have been directed to overcoming this. Dreher reports more than 30,000 grease interceptors in cantonments, and various units employed have been tested for efficiency by the Iowa State University. The National Restaurant Association is credited by the author with the statement that, if all restaurants and industrial cafeterias of the country were equipped with efficient grease traps, there would be a recovery of 10 to 15 million pounds of grease per month, based on the expected recovery of 14 lbs. per 1000 meals served.

Nelson, in describing the Dorr vacuator process, referred to the procedures followed in the larger cities. New York sells 90,000 lbs. monthly at 8 cents a lb., f.o.b. plant. It contains 53 per cent water, 37 per cent ether soluble matter and 10 per cent impurities. Chicago sells grease from the Southwest plant at 6 cents a lb.

Treatment of packinghouse wastes has been discussed by Hill of Chicago. Two methods were cited, one at Sioux Falls, S. D., and the other at Austin, Minn. In the former, the process consists of pre-treatment by sedimentation, followed by aeration, and filtration. The pre-treatment removes about 34 per cent of the B.O.D. and 58 per cent of the suspended solids. Continuous recirculation on the second stage filters gave improved results. The results at Austin on preliminary and final filters have not been as high as at Sioux Falls. Sludge disposal for these places is by digestion, but the procedures are not conclusive for this type of sludge.



Self-Cleaning Jeffry Bar Screens—The Rakes Approach from the Back.

Paper wastes problems have been attacked vigorously during the year. An important step in this was taken when the paper industry organized the National Council for Stream Improvement Inc., and appointed Dr. H. W. Gehm as Technical Advisor. The council will concern itself with research on waste treatment processes, and the recovery and utilization of waste by-products. The Mellon Institute at Pittsburgh is aiding in the research program.

Gehm pointed out that high degrees of treatment of white water from paper mills cannot be achieved economically at small plants, but that these wastes mix with domestic sewage and respond to treatment. Thirty to 50 per cent of the fiber can be removed by sedimentation with sewage, and this can be increased by flocculation ahead of settling. The return for reuse of 75 per cent of the white water waste is an important step. The suspended matter responds well to coagulants employed in sewage treatment. Further degree of treatment than that accomplished by save-all screens is required in many places.

The Michigan Engr. Expt. Sta. published a pamphlet on a study of paper mill waste disposal at the Kalamazoo Valley paper mills. Recirculation of white water and coagulation-sedimentation were stressed.

Wastes from synthetic rubber plants are voluminous and complex, and have been present now for a few years. Increase in solids and low pH interfere with plant operation, but do not interfere with sludge digestion.

Textile wastes do not lend themselves to recovery of by-products. Wise, of Hartford, Conn., refers to the problem created in the streams from these wastes. Chemical precipitation has been utilized and, in places where these wastes do not exceed 10 per cent of the volume of sewage, they can be handled in the treatment plant without difficulty.

Wise also refers to the use of barium sulphide as the most satisfactory reagent for dealing with plating wastes.

Wastes from food industries have been increased by more extensive canning and dehydration. Citrus fruit canning has necessitated a variety of methods of disposal.

Oil industry wastes have been reviewed extensively in a paper by Hart of the Atlantic Refining Co. Methods of disposal of these include gravity-type separators, removal of emulsions by chemical treatment, treatment of oxygen-consuming wastes by aeration or chemicals, and neutralization of acids or alkalis. This industry has increased so much during the war that major problems have arisen.

Activated sludge has been found to be successful in the removal of phenol wastes from the Midland plant of the Dow Chemical Co., according to T. E. Powers.

The above industrial wastes are but some of those which have been considered in the literature of the year. Dr. Symons of New York has reviewed this field and its future extensively in a paper read before the Canadian Institute on Sewage and Sanitation.

### *Increased Loadings on Treatment Plants*

Reference has been made in a number of papers to the increased loads on sewage treatment plants resulting from higher sewage flows and from concentrated industrial wastes. The numerous discharges from industries, where these are received into the public sewers instead of being treated separately, must create a serious load on many treat-

ment works in addition to interfering with the processes.

Corresponding with this aggravated waste loading on plants, there has been a higher flow of sewage. As an example of this, Bloodgood reported the results of a survey of five Indiana cities. The increases in flow varied from 6.7 to 41.8 per cent.

The New Brunswick, N. J., plant, built in 1937 for a designed flow of 9 mgd., was receiving flows of about 15 mgd. by the end of 1943. The concentration of the wastes increased as well. Such rapidly changing conditions make it difficult to design plants with any accurate prediction for the future, either in respect to changes in flow or concentration. Hence a flexible design is desirable.

At Wichita, Kan., the city engineer reported on a serious overloading of that plant, originally intended for a population of 160,000 but now treating the flow from a total of 200,000 population.

In the Province of Ontario a comparable situation has arisen in a considerable number of municipalities operating sewage treatment works. While large industrial plants have not been so numerous as in the United States, most of those in operation discharge direct to the public sewers, and the additional effect of this serious overloading on the plants means that many of the existing works will have to be materially extended after the war.

### *Stream Pollution*

Abatement of stream pollution must constitute a serious post-war objective and occupy a major part in post-war planning. Here again the accomplishments of the year are found in the plans for the future rather than actual improvements in the streams by recent construction.

The importance of stream sanitation has received recognition from many sources and in many countries. New legislation has been proposed and promises made to enforce statutes already in existence, in an effort to accomplish the desired end. As a measure for the conservation of national resources it ranks high.

As an example of the abatement program, the State of Pennsylvania may be cited. Statements on the work proposed have been made by H. E. Moses, Chief Engineer of the State Department of Health, and by Dr. A. H. Stewart, Chairman of the Sanitary Water Board. The 100,000 miles of streams have on their banks more than 1,000 incorporated municipalities.

It is believed that 500 municipalities will be affected in the post-war program of the State in order to reach that condition which has been stated thus: "The people have the fundamental right to clean streams and a supreme right to the original purity of the stream." It is estimated that this expenditure will be 60 million dollars for the Metropolitan Pittsburgh District, and 40 million dollars for the Philadelphia area.

Another program of extensive proportions is that proposed by the Interstate Sanitation District, and involving an expenditure of $120,000,000. This will be required to protect the welfare and recreational facilities of the people, and to prevent the great economic loss occasioned by gross pollution. Similarly, water pollution will be overcome in the Boston area. The harbor is now contaminated by over 250 mgd. of sewage.

Much legislation has been considered in the interest of pollution abatement. Federal activity is contained in the Barkley-Spence Bill. The Federation of Sewage Works Associations has endorsed the objectives of this bill, which is the elimination of stream pollution throughout the United States.

The action of the paper industries, to which reference has been made previously, in forming an organization voluntarily to correct stream pollution is an example which may well be emulated in the effort to provide for national results in stream sanitation. The American Iron and Steel Institute has had a similar program in operation for some years.

### *Research*

Research is an important instrument in the advance of any science, and everyone associated with sewerage problems is concerned with those studies which will aid in the solution of current difficulties. While the present period is an abnormal one, and adequate time and personnel have not been available, a good deal has been accomplished during the year by individual and cooperative effort.

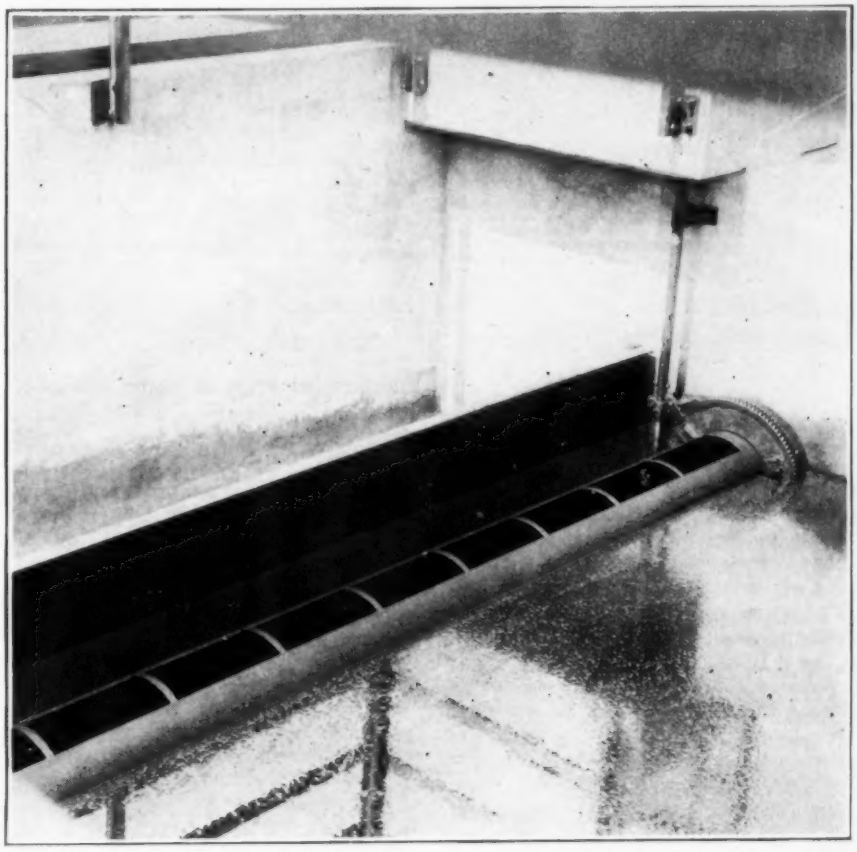
Reference should be made to the work of the Research Committee of the Federation of Sewage Works Associations, under the chairmanship of Dr. W. Rudolfs. The committee published two papers during the year, the first being a critical review of the 1943 literature, and the other a survey of research projects under investigation and requiring study for 1944.

An analysis of these research projects shows the number of problems under study as: sewage 35, industrial waste 49, sream pollution 5, methods 5. This also points to the interest at present manifest in the control of industrial wastes.

A further breakdown of sewage treatment studies shows 28 per cent of these on sludge, 23 per cent on filtration, and 27 per cent on activated sludge. The industrial waste studies are spread over a number of different items.

For the problems requiring investigation the trend is shown by the following list of 41 subjects submitted by the committee: sewage 15, industrial wastes 17, stream pollution 0, analytical methods 9.

In addition to the activity of the committee, the literature of the year has



**Chain-Belt's Worm Gear Operated Revolving Oil and Grease Collecting Pipe.**

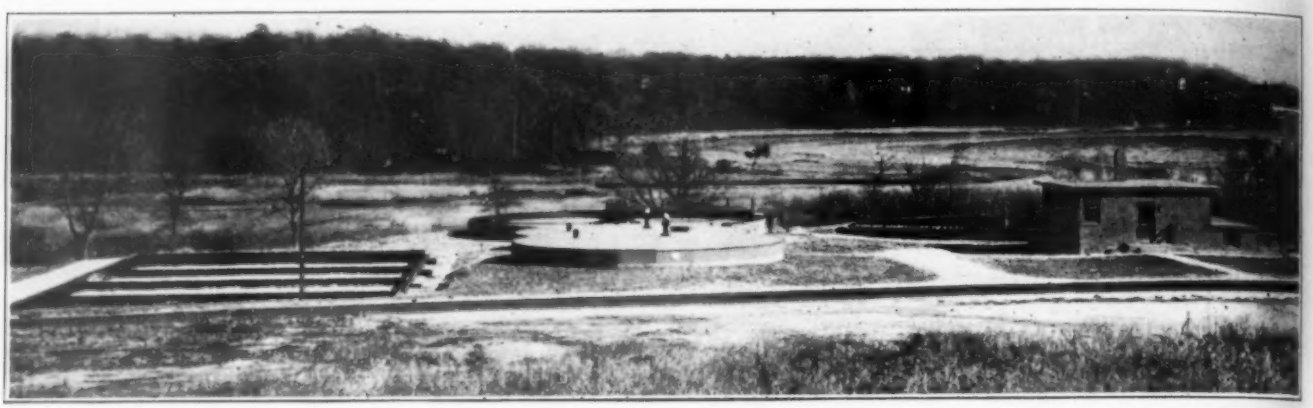
contained several papers dealing with research studies. Bloodgood, of Purdue University, dealt with the effect of temperature and organic loading upon activated sludge plant operation, concluding that both factors were important and that the rated capacity of activated sludge plants should be based on the mgd. of sewage of stated B.O.D. and specified temperature. Dr. C. N. Sawyer referred to the presence of fertilizing elements in sewage effluents, and the effects of these on the receiving water in the increased biological activity.

Rudolfs and Heukelekian have conducted surveys on the relationship between stream flow and quantities of nitrates, and concluded that the amount of nitrates can be correlated with the volume of water in the stream rather than being dependent on such factors as the degree of pollution and temperature of the water.

Straub of the USPHS has concluded that sodium nitrate had a decided effect on the digestion of paper pulp; in that it reduced the rate of gas production, reduced the methane content, increased the nitrogen content of the gas, and caused, in general, a more complete breakdown of the volatile solids.

Rudolfs has studied the decomposition of grease during digestion, stating that the rate and the degree of grease decomposition are greater than the destruction of other volatile matters present in sludges.

In England, the Institute of Sewage Purification has expressed the opinion that the regionalisation of sewage purification services would afford an opportunity for progress in sewage research of all kinds.



**Biofiltration Plant of Camp Evans, N. J.**

*(Is one of a number of small plants completed at Army and Navy Posts during the year, pictures of which have not been released to date.)*

### *Maintenance of Plant and Equipment*

War restrictions resulting in priority problems, with increasing wear on plants, have called for greater attention to the maintenance of structures and equipment. It has been necessary to conserve materials as never before, and the desire on the part of sewerage men to cooperate in this effort is reflected in the number of papers that have dealt with this subject. This applies to the entire sewerage facilities, and especially to mechanical equipment.

This attention focused on mechanical equipment will serve a useful purpose, since treatment plants are becoming highly mechanized. In addition to maintenance, it has been necessary to revamp a number of old works to provide extra treatment and to meet new conditions. This has made it possible to accomplish gratifying results at a minimum of expenditure and work. Recirculation of sewage through trickling filters may be mentioned here as an example.

Sewer maintenance has centered about the application of safety measures. The Ohio State Department of Health has prepared a report on "Gas Hazards in Sewerage Systems and Sewage Treatment Works in Ohio." The practical side of safety has been discussed by Wilt of Detroit, in which he refers to the administration of safety measures. The Federation Conference had on its program a most enlightening discussion and demonstration of safety measures, in which all phases of this work were outlined.

The cleaning and maintenance of sewers by the use of modern methods and equipment has been described in articles dealing with procedures at La Crosse, Wis., and Bay City, Mich. In the former, the maintenance of the sewers has been placed under control of the treatment plant personnel. Bay City has in operation a truck for servicing house laterals in an efficient manner.

Los Angeles has been conspicuous in the procedures employed for maintenance of over 2700 miles of sewers, and for the safety measures that have been worked out for this.

### *Operating Data*

The year's literature contains numerous references on operating results, as to what is being accomplished in the different plants, how costs are reduced, capacities increased, and new devices worked out to meet special conditions. War-time operation is difficult, and new problems must be faced, but this experience in operation will be most valuable for the post-war construction of new works.

The importance of operating records has been stressed on different occasions, both for the sake of efficiency and for information for others in similar positions. A good operator will ensure adequate reports.

Activated sludge plants have provided useful data. Howson and Mathews have reported on three years of operation of the Gary, Ind., plant, and with reference to the effects of iron wastes on the process. The last figures available show a reduction of 96.58 per cent in suspended solids and 93.5 per cent in B.O.D. at a cost for operation of $8.70 per mil. gal. or $8.67 per 1000 lbs. of B.O.D. removed.

Bloodgood reports on the application of the sludge index test to plant operation. At Mansfield, Ohio, Turner uses an average of 750 ppm. suspended solids in the mixed liquor and his sludge index for optimum operation is 660. Information from army camps using activated sludge works has been reported in detail in a paper by Koruza, in which operating difficulties are outlined.

Valuable operating data have come from Chicago, Cleveland and New York on activated sludge plants.

Reports contain several references to sludge problems—how Springfield, Mass., with elutriation, uses 1½ per cent ferric chloride; how non-saponifiable grease is siphoned off the top of the digestion tank; how Rocky Mount, N. C., sells sludge gas to the local consumers; and how the Joint Meeting sewage plant at Elizabeth, N. J., barges the sludge to sea at a cost of 38 cents per wet ton of about 9 per cent solids, etc.

Efforts to reduce the cost of treatment are seen in many reports, and how improvement can be accomplished by joint operation with other utilities. Some other items in these reports include the methods of servicing diffusers at Jackson, Mich., pumping station op-

eration at Winnipeg, Can., and grit handling at Buffalo.

### *Sewer Design and Construction*

No large amount of major construction work in sewers has characterized the year. A 15-mile sewer project at Memphis, 30-in. to 48-in. diameter, involved some innovations. Heavy timber shoring was used to advantage; tunnels were built from two headings; and siphons were built on concrete mats in the form of dual sewers. At Bridgeport, Conn., a double sewer siphon, 24-in. diameter, of cast iron pipe, was pulled into place successfully over a tidal stream. The pipes are each 240 ft. long and are spaced 5 ft. c. to c.

Dr. W. L. Malcolm published a comprehensive paper on sewer design practices in the United States. C. H. Coberly contributed an article on the re-examination of some of the fundamentals of design and construction of sewers, in which emphasis was placed on the importance of checking the various details carefully in order to assist in sewage disposal.

### *Progress in Sewage Treatment Processes*

Under the heading of sewage treatment processes, a most comprehensive report was published during the year from a Committee on Sewerage and Sewage Treatment of the ASCE and under the chairmanship of Langdon Pearse of Chicago. This deals with the advances in sewage treatment and present status of the art.

Developments in sewage treatment processes for the year have dealt chiefly with activated sludge and high rate trickling filters. On the former, a number of papers have appeared. The factors significant in longitudinal mixing in aeration tanks were given by Thomas and McKee. Experimental work by Ridenour and Greenbank dealt with the effect of cyanide case hardening, copper and zinc plating wastes on activated sludge treatment. Carburizing waste affected nitrification at 500 ppm., and suspended solids and sludge settling at 2200 ppm. Copper plating and zinc plating wastes affected nitrification at 500 ppm., and the other two factors at 1200 ppm. Sodium cyanide completely destroyed nitrification at 40 ppm.

Attention has been centered on high rate activated sludge treatment as a means of economy between sedimentation and standard activated sludge, with reduced aeration and lower air consumption. The work carried on at New York has yielded additional data. It has been concluded that treatment reaches a critical value when the suspended solids in the aeration tank exceed 600 to 800 ppm. The adoption of this process for the proposed Los Angeles plant is one of the latest.

Further data have appeared on high rate filtration plants, and the use of this process for concentrated wastes and sewage is recognized. The States of Wisconsin and Minnesota have issued a joint statement on standards for these filters, and set up figures which will be adopted for review of plans submitted for approval.

This subject has also been given considerable attention in England, and efforts have been directed to increase the work done by percolating beds.

The design of final settling tanks was discussed by Anderson of Chicago, with reference to density currents. The radius of circular tanks should not be greater than 5 times the sidewall depth, and for rectangular tanks the length should not exceed 7 times the depth. The depth below the effluent weir must be not less than 10 ft., to prevent density of currents causing disturbance in the solids.

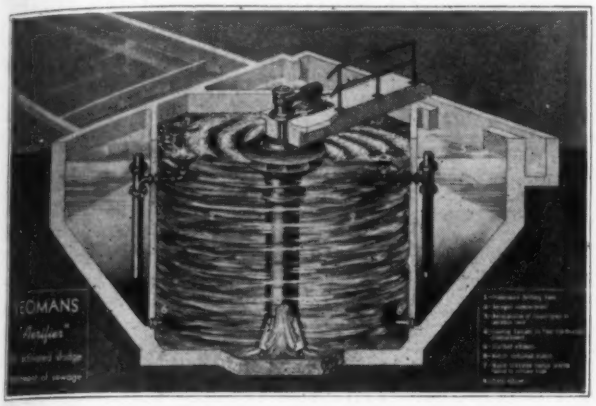
### *Equipment Development*

The year has not brought any significant changes in the development of new equipment. The reason will be obvious in that manufacturers in this field have been fully employed on direct war activities, and little opportunity has been afforded for study and testing new devices. Until the present conditions change, it can be expected that present-day designs will be employed.

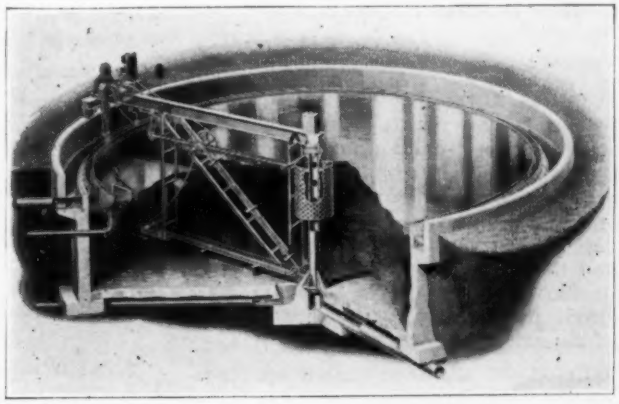
Where time has been available for development purposes most companies have endeavored to add refinements to existing processes, and to give some thought to new methods which may be perfected after the war.

### *Chlorination*

Chlorination of sewage and industrial wastes has made marked progress in recent years, and the application of this treatment has been expanding to a degree in which water processing is being challenged.




Yeomans' Aerifier for Activated Sludge Treatment.



Link-Belt's Circuline Sludge Collector.

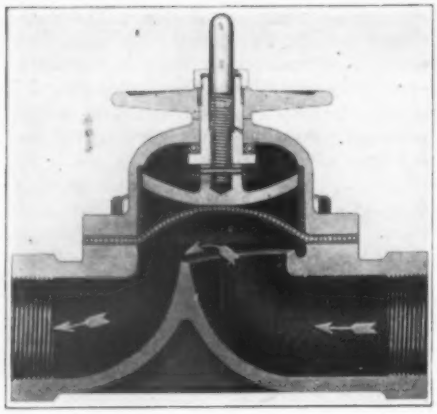
As an example of a modern use of chlorine, the control of the sludge index in activated sludge plants may be cited. In this it has been established that the chlorine dosage required to control the sludge index can be determined and is based on the relationship that the dosage is a function of the sludge index and the dry weight of the solids in the return sludge.

Major changes in chlorine equipment and chlorine application to sewage have not appeared but, with a gradual increase in knowledge, it is apparent that more may be expected from this in the future. It is now estimated that nearly 1800 sewage plants in the United States are using chlorination.

### *Sludge Disposal*

Sludge disposal is a continuing problem, and has been prominent in the activities of the year. No single method has been adopted or even recommended. Many data have been accumulated during recent years on disposal embraced under the more common methods as: barging to sea, wet disposal on land, drying on open or covered sand beds, vacuum filtration, heat drying, fertilizer use, and incineration. Plants built for army and navy use in recent years have contributed much to this information.

While many methods of sludge disposal are in use, the trend has been towards digestion and to the use of the gas so produced. Schlenz, of the Pacific Flush Tank Co., has reported that



New McAlear Diaphram Valve.

in the U. S. there is now over 70 million cu. ft. of separate sludge digestion, serving over 30 million population, and that almost 40,000 bhp. is being generated in the U. S. from the gas secured from this digestion. Schlenz has also described the "Controlled Digestion" and the various items which contribute to the efficiency of this process, and result in the speeding up and control of digestion.

Emphasis has been placed on stage digestion and the control of scum. The use of ammonium sulphate circulated through the tanks has been reported favorably in a number of places. Heating of tanks has been obtained by direct steam, and by heat exchangers or piping outside the tanks. Copper in excess of 3000 ppm. in the tank gave trouble at Kenosha, Wis. Mineral oils cause trouble in the tanks, and means have been utilized to siphon this off in Springfield, Mass.

At Cleveland, studies have been under way for dealing with the supernatant liquor from the southerly plant which receives sludge from the easterly plant as well. It is hoped to be able to reduce the strength of this liquor to near that of raw sewage and thus lower the treatment burden.

Elutriation is now in use in 13 plants in the U. S. and one in Canada, and interesting results are being secured. The latest of these is Stamford, Conn. Sludge gas engines are being used to operate blowers, pumps and generators. The use of a dual fuel engine for this field is now applicable.

Babbitt has reported 12 places in all using the disposal of garbage with the sewage, and emphasizes that it offers a number of advantages.

During the year an interesting development in sludge disposal has taken place at Stamford, Conn., and it is combined with a refuse handling project. The refuse incinerator functions with the sewage treatment works as a single operating unit. The sewage is given primary treatment by sedimentation and the sludge is handled in multi-digestion tanks, three in number. It is elutriated by the counter current process, and provides both a primary and a secondary elutriation tank. The primary digesters maintain the temperature at 96° F. Clarified effluent is used for wash water, in the ratio of 4 parts of water to 1 of sludge. The sludge is dewatered by vacuum filtration, and is dried by a Raymond flash drier. Heat is derived from the refuse incinerator. The sludge, when dried, may be used as a fertilizer or be incinerated.

The application of sludge for fertilizer continues in a number of places to advantage. Some is dried for shipment and some is applied in the wet state. At Anderson, Ind., wet sludge from a population of 55,000 has been applied since 1940 in liquid form on a farm of 60 acres, after digestion. Wet sludge is applied to land in a number of places in Ontario.

Reference has been made, in a paper by Niles, to those properties present in sludge in small quantities which may have an important effect on its fertilizing properties. Chicago and Milwaukee have continued the sale of dried sludge fertilizer to advantage, with improved prices prevailing.

### *Administration*

Administration of sewerage sysems has received increasing attention, as there becomes a greater interest in providing the necessary works and in arranging for financing these in the most acceptable manner. Provision for qualified operators is becoming more essential, and the program of certification and licensing is proceeding nicely. New York State now has certified 516 plant operators. The Federation has assisted materially in the certification program.

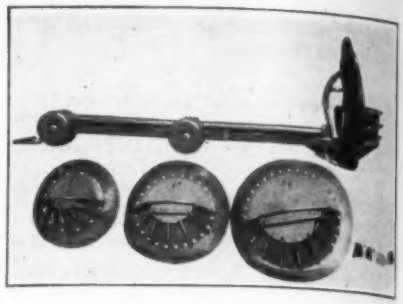
While joint administration of sewerage works with other municipal utilities is not widely practiced, it is growing and the advantages of this system have been pointed out in places where the method is in use. In some places utility commissions have been widely adopted, and in smaller centers where municipal departments may be joined this combination of water and sewage units has attractive possibilities. The Province of Ontario has had wide experience in public utilities, but not for sewerage.

### *Financing Sewerage Work*

Financing of sewerage works has received an impetus from two directions: the increasing use of sewer rental for meeting annual charges, and the adoption of rate charges for industrial wastes.

A number of cities have adopted sewer rental programs during the year, with Philadelphia becoming one of the latest. This took effect January 1, 1945. The rate schedule there for industrial wastes has been studied for some time. This is an encouraging aspect for the participation by industry in the cost of treatment by this means.

LaDue has outlined the procedure



The Fitzgerald Sewer Scooter.

followed at Akron, Ohio, in the collection of sewer rentals in the water bill and with water and sewerage being administered as a single unit. Here the surplus water funds go to pay the sewage costs, under a code in use there.

Symons and Crane have reported on studies in Buffalo on industrial wastes, and have developed a formula for arriving at the proper charge. It is to apply to any industry which has wastes with a chlorine demand or suspended solids three times that of the sewage.

New Brunswick, N. J., has adopted a charge for industries based on the following: $22.00 per mil. gal. flow of waste, plus $5.00 per ton of sludge present, and $5.00 per 100 lbs. of chlorine demand. Where the charge for an industry exceeds $1000 per year, a continuous recording of the flow is to be applied.

These are interesting developments in an effort to adjust as equitably as feasible the problem of payment for service rendered. It is likewise typical of the trend to relieve real estate of some of the burden of taxation.

### *Association Progress*

The year has seen substantial progress in the activities of associations in the sewerage field, and this in spite of all the restrictions of war. The Federation of Sewage Works Associations held a most successful conference at Pittsburgh, and forward steps have been taken by the Board of Control to further the interests of this field. The activities of the various committees are contributing effectively to the advancement of the science.

Member associations, which form such an important part in sewerage work, have also held successful meetings, and these are creating valuable assets for those engaged in this work.

In general, 1944 may be considered as a year of progress, and especially of preparation for major developments to come; a year in which personnel in the sanitary field have had to carry on under difficult circumstances, but a year which has further demonstrated that sewerage programs on this continent are proceeding apace to a conspicuous place in the sanitary and municipal sphere of endeavor.

# EMPLOYEE PROFIT-SHARING PLAN ADOPTED BY WAUKESHA WATER UTILITY

## An Innovation in Publicly Owned Utility Operation; Supplements the Salary Savings Plan Adopted Seven Years Ago When Social Security Benefits Were Denied Municipal Employees.

By ARTHUR P. KURANZ*
Manager
CITY WATER UTILITY
WAUKESHA, WIS.

THE idea of employees sharing in the profits of a manufacturing plant or private business is not new. On the other hand employee profit-sharing in a municipally-owned and operated utility is probably NEWS. However, this radical departure in conception and operation of a municipal water utility is now a FACT, for Waukesha, Wisconsin, has put a profit-sharing plan into effect and has made it retroactive for the year 1944 in addition.

Basically, the idea of employees sharing in the profits of the company for which they work very likely originated from the statement often made that "a laborer is worth his hire." Many manufacturing plants, too, have inaugurated this system as an incentive to the employees to contribute to the improvement of the product manufactured, or to boost the net operating results of the business, particularly from the standpoint of reduction in production costs and increase in net profits.

During these times of difficult labor problems, much talk—and most of it loose talk—has been spread concerning the vicious practices of business, particularly "big business," and the employee feels that he has not shared in the fruits of his labor as he thinks he should. This is not true of all employees, but a good many of them feel just that way and, on this basis, the agitation which has been fomented has caused many difficulties, not only between employees and management, but in the final results in the services rendered to the consuming public.

### *A Profit-Sharing Plan Suggested for Water Works Employees*

With these thoughts running through our minds in Waukesha, it was felt that perhaps a move should be made in the direction of asking the employees of the City Water Utility to share, at least partially, in the responsibilities of operating the business and, consequently, share to some extent in the fruits of their efforts. Therefore, it was suggested to the Utility Commissioners of Waukesha more than a year ago that a Profit-Sharing Plan for the employees of our Water Utility be adopted.

*This article, credited to Mr. Kuranz, is a staff production from information supplied WATER WORKS AND SEWERAGE by Mr. Kuranz at our request. However, for the most part the story is in the exact words of Mr. Kuranz as given us.—Editor.

Arthur P. Kuranz

It might be argued that this is illegal and morally improper since the municipally-owned utility is supposed to operate in such a way that any profit accrued would belong to the municipality-at-large. This line of reasoning is perfectly clear and understandable, and perhaps even proper if one subscribes to the Communistic viewpoint, wherein all work for one—and that one being the State. On the other hand, municipal utilities, particularly those in Wisconsin, have been permitted by the Public Service Commission, as well as Wisconsin Statutes, to earn a fair profit on investment in the public Utility, just as in the case of the private utility. This fair profit has been determined as being normally 6% on the capital structure. Since provisions are made in the operating expenses to take care of local taxes on the utility, as well as a Depreciation Reserve Fund, and in the case of the Waukesha Water Utility, arrangements are also made to pay dividends on the City's Equity in the utility. It seems reasonable, therefore, that those who have the direct responsibility of operating the utility in such a way that taxes, depreciation, and dividends can be paid, with a net profit remaining, should also participate in such earnings.

### *Plan Adopted for Two Year Trial Period*

After considerable study and discussion of this problem during the past year, it was finally decided by the Utility Commissioners to establish a Profit-Sharing Plan on a trial basis for two years. The Plan will be very carefully watched during the year 1945 to see whether it does have the anticipated effect. Continuance of the Plan rests to a considerable extent on the employees' reaction, and what the records reveal during the trial period. Should there be a definite improvement in the operation of the Utility and/or a reduction in operating costs, I am sure that the Water Utility Commission will continue or expand the plan. The very fact that the Commission, after giving deliberate consideration, adopted the plan with unanimous approval leads me to believe that even the political reactions have been given more than passing thought. The Water Utility Commission is composed of three citizen members, along with the Mayor as ex-officio, and one member of the Common Council as liaison representative between the Utility and the Council. Both, however, have a vote on the Commission.

Even though the idea of a municipal utility offering a Profit-Sharing Plan to its employees is a radical departure in the field of municipal administration, still the feeling prevails in Waukesha, that without a trial no definite results could be determined. We are, of course, hopeful that this departure from accepted practice will prove to be a successful innovation in municipal utility operation and management. Only trial will tell.

### *The Proposal in Part*

[The following are excerpts taken from the concrete proposal made by Mr. Kuranz in July, 1944, to the Water Utility Commissioners—and the Mayor of Waukesha—to try the Profit-Sharing Plans as a two-year experiment in municipal utility management.—Editor.]

In order to get this matter clearly before you, the comparative income accounts as taken from our audit will serve as a basis for discussion.

**Net Income Records (to the Nearest Dollar)**

| 1941 | 1942 | 1943 | 1944 |
|---|---|---|---|
| $39,613 | $43,876 | $49,632 | $49,000* |

In arriving at this net income, retirement expense and taxes have both been deducted. Personally, I like to take into consideration another item,

*All 1944 figures are approximations made in July, 1944, for the purpose of this report.

namely, the dividends paid each year on the City Equity. These follow:

| 1941 | 1942 | 1943 | 1944 |
|---|---|---|---|
| $14,400 | $14,000 | $13,600 | $13,200 |

This then leaves a residue in the net profit account as follows:

| 1941 | 1942 | 1943 | 1944 |
|---|---|---|---|
| $25,213 | $29,875 | $36,032 | $35,800* |

Since the utility pays a 4% dividend on the City Equity, it is suggested that 4% of the final net be distributed amongst the employees on the basis of their salaries or wages.

Our payroll (to the nearest dollar) has been as follows:

| 1941 | 1942 | 1943 | 1944 |
|---|---|---|---|
| $31,552 | $29,300 | $27,178 | $28,000* |

The total amount of profit (to the nearest dollar) which would have been shared with the employees on the basis of 4% of final net follows:

| 1941 | 1942 | 1943 | 1944 |
|---|---|---|---|
| $1,009 | $1,115 | $1,441 | $1,432* |

On the basis of the above amounts to be equitably distributed amongst employees we find that in 1941 it would have amounted to 3.2% of each employee's yearly salary; in 1942, to 3.8%; in 1943 to 5.3%; and approximately 5% for 1944, can be predicted. The reason for a lower payroll in 1943 and 1944 is due to the fact that we are getting along with three men less than we normally do. Since most of our employees are receiving $2,160 a year (including the amounts paid into our Salary Savings Plan), it means that such employees would have received approximately $69.00 bonus in 1941 and $108.00 in 1944. As the payroll and the net residual profit varies so will the bonus in terms of dollars to the individual employee. The lower the payroll and operating expense the greater the bonus of course.

The bonus, I believe, would have a very definite effect on better labor relations, not only between personnel and management but also between personnel, utility, and the City. I feel that if each employee understands that he is to share in whatever savings he can help make, he will be just that much more anxious to give his best cooperation in attaining economical operation of the utility and, ultimately, in eliminating the least efficient employees from the payroll. I would suggest that we try this plan for a period of two years, and, if not satisfactory after that time, it can and should be abandoned.

### *The Result*

After studying the above proposal made by Mr. Kuranz during a 5-month period the Water Utility Commission of three members—J. C. Laing, President; E. M. Junemann and H. E. Blair, together with Mayor George Coutts, and Council Representative L. M. Atkinson, held a special meeting on January 6, 1945 from which the following resolution emerged as unanimously approved by all members. Motion—

"That the Waukesha Water Utility adopt the Employees Profit-Sharing Plan advocated by A. P. Kuranz, manager, for the years 1944 and 1945 on a two-year trial basis, as follows:

THAT, the employees shall share in the net income of the Waukesha Water Utility as determined by the Auditors engaged by the Water Utility Commission each year.

THAT, the net income will be the amount remaining after retirement expenses, local taxes, and dividends on the City Equity have been deducted.

THAT, the employees share to the extent of 4% of this net residual income but that no employee's share shall exceed $150.00 per year.

THAT, each employee who has been with the Waukesha Water Utility for a period of six months or longer during the years in which the plan is effective shall share on the basis of his total wages and salary, including the Salary Savings Plan now in effect for the employees of the Waukesha Water Utility.

THAT, said profit-sharing payment shall be made only after the auditors engaged by the Water Utility Commission have made their report covering the year for which the profit-sharing distribution is to be made.

THAT, the plan shall be considered as part of the wages and salaries paid to each employee.

[Note that the years 1944 and 1945 are involved, with bonus payments being made early in 1945 and 1946.—Ed.]

### *A Letter from the Manager*

To each Water Utility employee went a copy of the above approved motion accompanied by a letter from Manager Kuranz in which he commented as follows:

"I believe it should result in better operation of the Water Utility in every respect, because now each employee will share in the results of his own efforts. And, I hope that the result will be of such a nature that the Water Utility Commission will see fit to keep this plan in effect from year to year. You will notice that the plan is only for the years 1944 and 1945, and it remains with the Water Utility Commission to adopt it for subsequent years, or reject it depending upon the reaction of the employees."

[It is our belief that the Motion and the accompanying letter are the first of their kind ever to be produced. Should our readers know of a parallel to this innovation, representing such a radical departure in municipally-owned utility operation, we should like to learn of it.—Ed.]

### *The Salary Savings Plan*

In as much as the Salary Savings Plan of the Waukesha Water Utility has been mentioned in connection with the Profit-Sharing Plan, it is well to also briefly describe this earlier benefit to employees.

Seven years ago when it became known that municipal employees were not to be included in the beneficial Social Security Plan of the Federal Government, the Waukesha Water Utility Commission placed in effect a Salary Savings Plan for employees.

Essentially this Plan consists of the systematic purchase of Retirement Annuity Insurance fo rthe employee. Toward this benefit the Water Utility contributes two dollars to every dollar which the employee invests from his pay. This contribution to the employee's retirement fund is considered as an increase in wages or salary to those who elect to participate in the Plan by authorizing pay deductions monthly in the amount of 33% while The Water Utility contributes 66% to the fund which is systematically invested in Retirement Annuity Insurance. The policies are separate units taken out in the individual employee's name.

Should the employee leave the Water Utility or be discharged he can take with him the policies held in his interest, without loss of any beneficial interest, paid in by the Utility. However, there are several features in the Plan designed to encourage employees to remain in the employ of the Utility. Of course a ceiling had to be set for the maximum permissible monthly investment per employee, since the Water Utility contributes 66% of the total. During the seven years in which the plan has been operative the maximum employee contribution has been fixed at $5 monthly, meaning a $10 contribution monthly by the Utility. However, the systematic investment of $15 monthly in Retirement Annuity Contracts represents a very satisfactory security fund for the average water works employee. Over the seven-year period this has amounted to $1,260 invested to the benefit of all those employees who have kept up their payments. Of this amount the Utility has contributed $840 and the employee $420.

In addition to Waukesha similar retirement or Salary Savings Plans have been adopted by two other Wisconsin Municipal Water Utilities — Madison and Manitowoc—with approval of the Wisconsin Public Service Commission being given in each instance.

## "Operation of Water Filtration Plants"

### Out of Print N. C. Bulletin Under Revision

If you have occasion to refer to list No. 1 in the "Information on Water and Sewage Works Problems," contained in the Reference & Data Section of the June, 1944, issue of "Water Works & Sewerage," you will note listed a bulletin by the North Carolina State Board of Health entitled "The Operation of Water Filtration Plants."

We have been advised by J. M. Jarrett, Director of the Division of Sanitary Engineering, that this bulletin is now out of print and is in process of being revised. As soon as the revised bulletin is available, we shall make a further announcement.

# A.W.W.A. BOARD ACTIONS

## Thompson for President; LaDue for Vice-Pres.; Brush for Treasurer. Goodell Prize to H. V. Pedersen; No Diven Medal Award for 1944. Honorary Memberships to Angus, Booth and Chevalier.

## Adopts Code of Practices for A.W.W.A. Members; Goes Along with Washington on Indefinite Postponement of National Conference, but Voices Opinion That to Cancel Section Meetings Would Be Mistake.

ON January 15 and 16 the Annual Meeting of the Board of the American Water Works Association was held in New York City. Thirty-one of the thirty-four Directors were present, including the Director from the Cuban Section.

**Leonard N. Thompson**
*(For President)*

The Nominating Board, consisting of Section Directors only, chose the following as officers for the next convention-to-convention year:

**For President**

Leonard N. Thompson, Genl. Supt. & Engr., Water Department of St. Paul, Minn.

**For Vice-President**

Wendell R. La Due, Chief Engr. & Supt. Division of Water and Sewerage, Akron, Ohio.

**For Treasurer**

William W. Brush, Editor, "Water Works Engineering," New York City.

(Mr. Brush has held this office for 19 terms, and is now nominated for his 20th term.)

### *Awards and Honors Voted*

The Board conferred Honorary Membership on the following three members.

**Robert W. Augus,** Professor Emeritus, Univ. of Toronto, Canada.

**George W. Booth,** Chief Engr., National Board of Fire Underwriters, New York, N. Y.

**Willard Chevalier,** Vice-Pres., McGraw-Hill Pub. Co., New York, N. Y.

The John M. Goodell Prize, awarded the author of the most meritorious paper published during the year in the A.W.W.A. Journal, was voted to **H. V. Pedersen,** Supt. of Water, Marshalltown, Ia., for his paper "Calcining Sludge from a Softening Plant" which appeared in the AWWA Journal for November, 1944. Mr. Pedersen was cited for "his diligent attack upon an important subject and his demonstration of the ability of a mentally alert water works executive to give effective attention to give effective attention to problems beyond his daily routine."

### *No Diven Medal for 1944*

The Committee on the John M. Diven Medal Award, consisting of Messers. Pirnie (Chairman), Enslow (Vice-chairman), Amsbary, Decker and Kuranz, recommended to the Board that no award of the Diven Medal be made for the year 1944. It stated that while it is significant that wartime demands for full capacity service of A.W.W.A. members within their own fields of direct responsibility have prevented their carrying on such services as have previously been the basis of the Diven Medal Award, many conspicuous services of a regional rather than a continental nature have been rendered.

The committee called attention to the meritorious services of Albert E. Berry (Toronto), Ellsworth L. Filby (Kansas City), Joseph L. Quinn, Jr. (Indianapolis) and W. Victor Weir (St. Louis). It also recorded full appreciation for work done by Association members beyond the line of duty in the interest of the water works profession.

**Wm. W. Brush**
*(For Treasurer)*

In summation, it was the reasoning of the committee that awards and honors should not be made when the case is not sufficiently clear cut to preclude extended argument for this or that potential recipient. The committee therefore felt that the prestige and dignity of the John M. Diven Memorial Award would best be served, if not actually enhanced, by acceptance of its recommendation that no award be made for the year 1944.

The Board commended the Committee and accepted the recommendations.

### *An Important Resolution Adopted*

The Board took notice of the serious limitations upon efficient water works operation resulting from manpower losses. The following resolution was adopted and ordered sent to:—The President of the United States; the Presiding Officer of the U. S. Senate; the Speaker of the House of Representatives; the Chief of Staff, U. S. Army; the Chief of Staff, U. S. Navy; the Chairman, War Production Board; the Director, Bureau of Selective Service; the Chairman, War Manpower Commission; the Executive Director, National War Labor Board; the Director, War Mobilization and Reconversion; and all members of the American Water Works Association:—

**Wendell R. La Due**
*(For Vice-Pres.)*

"The Board of Directors of the American Water Works Association, here assembled and representing all of the major public water supply agencies in the United States, expresses its full appreciation for the cooperation extended to the industry by many governmental agencies since the outbreak of the war, and to reaffirm its desire to continue to render maximum service in the nation's war effort in the future as it has in the past.

"The water works profession feels, however, that under present regulations of manpower, and to some extent under wage and hour requirements, necessary water service cannot be guaranteed in the coming months, unless remedial measures are provided. Accordingly, the following resolutions have been adopted:

"WHEREAS, the members of the Board of Directors of the American Water Works Association, speaking for the Water Works Profession as a whole, are seriously alarmed by loss of per-

sonnel from public water supply agencies, and more generally by a seeming lack of recognition of the essentiality of this industry to the war effort and the production of military supplies; and

"WHEREAS, it is obvious that the failure of the water supply in any community can constitute a major disaster, and can result in the cessation of important industrial activities therein; and

"WHEREAS, it is deemed advisable to invite the attention of all our governing and administrative bodies—national, state, and municipal—to the necessity of placing the water supply industry on a basis of equality with other critical war industries;

"THEREFORE, BE IT RESOLVED, that attention is invited to the following facts:—

"Certain governmental agencies now rate the manpower requirements of the water works industry below similar requirements of other war industries;

"That compensation allowed to water utilities employees by certain governmental agencies is neither adequate enough to hold experienced employees, nor adequate enough to secure competent replacements;

"That the number of operators, and the efficiency of the replacements provided for such operators, already in many communities have been reduced to dangerously low levels;

"That a positive threat, because of these conditions, now menaces public water supply operations and will, if water supply fails, menace industrial production, endanger the health of the citizens, and jeopardize their protection from the hazards of fire.

"BE IT RESOLVED FURTHER, that the American Water Works Association, through its Board of Directors, therefore requests authoritative reconsideration of the needs of the industry, and to every degree possible, the upgrading of the industry in regulatory directives, to the position to which by reason of its vital functions, and in the public interest, public water supply service is entitled."

### *Public Relations and Appreciation of Water Supply Importance to Be Advanced by A.W.W.A.*

A Publicity and Public Relations Committee was advocated and authorized by the Board. The principal duty of this important committee will be to develop ways and means to promote and maintain a more adequate popular understanding of the vital relationship of public water supply to the safety, progress and welfare of the community and its industries, existing and potential.

The Board in calling for the establishment of this new committee, expressed the feeling that had public water supply been more adequately "sold" to the general public in earlier years, it would have been more adequately recognized and treated as the critical industry, that it is, by Federal agencies and officials responsible for seeing that there be no home-front or industrial failures to cripple the war effort. Aside from the status of water supply in the war program, the local water utility would have enjoyed a higher standing in the administration and budgeting of municipal enterprise.

### *Water Quality Standards —Present and Future*

The Board referred to its resolutions of January, 1944 upon the subject of the U.S.P.H.S. Drinking Water Standards. (See W.W.&S.—Feb., 1944—p. 50.) The consideration given to these resolutions, as well as to the committee representing the A.W.W.A. which conferred with U.S.P.H.S. officials during 1944, was gratefully appreciated by the Board. The Board also expressed its relief as a result of the clarification of the administrative intent of the U.S.P.H.S., evidenced by the promulgation of Circular Letter No. 85, which was published in the Nov., 1944, issue of the A.W.W.A. Journal.

The Board reached the opinion that whereas, certain primary differences of viewpoint have not been reconciled, that further efforts should be made to develop an understanding between the U.S.P.H.S. and the public water supply industry, to the end that the Federal Standards for water used on interstate carriers may also be accepted as a standard for public water supply in the United States in general. The resolution adopted by the Board follows:—

"RESOLVED that a special committee be appointed to review with U.S.P.H.S. officers present divergences of opinion concerning the 1942 Drinking Water Standards and if possible, to reconcile these differences with the ultimate objective of accepting cooperatively modified Standards for application to *all* public water supplies in the United States."

### *Activities of the W. W. Practice Committee*

The full report by the Committee on Water Works Practice will be published in the March issue of the A.W.W.A. Journal. Some of the new important considerations and actions are the following.

The two sub-committees on Safe Handling of Water Works Chemicals and on Pipe Line Coefficients were discharged as having completed their assignments. However, it was the opinion that the Committee on Coefficients should be re-established when the taking up additional studies of the causes and corrections for pipe line capacity losses is again permissible.

The Committee on Distribution System Safety is to be re-activated (W.E. Stanley, Chairman) in view of the increasing evidence of need for rendering water supply distribution systems as far as possible from hazardous cross connections, and other deficiencies which may vitiate the quality of water as it is introduced into the distribution system. This action should be reassuring to the U. S. Public Health Service, and health authorities in general.

A review of the actions and report of the Special Committee on Depreciation of Water Supply Facilities (Louis R. Howson, Chairman) was presented. No exception to either was made by any member of the Board. The committee was requested to continue its activity, to keep the Association informed concerning rulings or orders relating to depreciation practice, and to establish liaison with similar committees of the American Society of Civil Engineers, American Institute of Accountants, and the American Bar Association, to the end that these professional groups develop a unified expression of their attitude on depreciation policies.

The Board expressed full support of

**Recipients of Honors and Awards**

**Prof. R. W. Angus**
*(Honorary Member)*

**Geo. W. Booth**
*(Honorary Member)*

**Col. Willard Chevalier**
*(Honorary Member)*

**H. V. Pedersen**
*(Goodell Prize Winner)*

the position taken by its representative (Chas. F. Meyerherm) on the Grounding Sub-Committee of the National Electrical Code. His opposition to further extension of the use of water service pipes for grounding electric services had been recorded by memorandum to the entire sub-committee.

### *New Committee on Water Use For Air-Conditioning*

The Board recognized the problem of water supply for space cooling and air conditioning in the post-war period when market growth in air cooling is anticipated. It reviewed the resolution passed by the Virginia Section at its annual meeting on Nov. 14th to the effect that, until such time as other action may be taken by the parent Association, the Virginia Section recommends that no water utility should be expected to supply water for use in refrigeration for air-cooling or other use at a *rate* in excess of 0.05 gallons per minute (72 gals./24 hrs.) per ton of refrigeration capacity for systems being installed or enlarged. A copy of this action by the Virginia Section was sent to every water utility located in the State. It was reasoned that modern equipment would function adequately with this rate of water use or less, depending upon temperature. Therefore, to discourage any inclination to purchase, and pressure of sales organizations to sell, equipment of lower first cost but embarassingly high water consumption for cooling and waste to sewer, this action was taken by the Virginia Section.

With an aim toward fostering the most efficient use of cooling water for refrigeration and the least overall expense to the consumer, as well as the water utility supplying seasonal peak cooling demands, the Board authorized the establishment of a special committee on water use in Refrigeration and Air Conditioning.

### *"Code of Practice" Adopted*

As one of its concluding actions, at a session attended also by Section Secretaries from 22 of the 25 A.W.W.A. Sections, the Board reviewed the "Code of Practice" for members, developed by and proposed for consideration by Secretary Jordan. After some discussion and appraisal the Board unanimously approved this document as the official A.W.W.A. "Code of Practice for Members." This code, which was so highly regarded, is here reproduced in full.

## MEMBER'S CODE OF PRACTICE

### AMERICAN WATER WORKS ASSOCIATION

*As one engaged in providing public water supply for the people that I serve and as a member of the American Water Works Association, I hold to these principles:*

*I. To the best of my ability I shall conduct all operations under my control in such manner as will, as far as the means made available permit, provide adequate water service, preserve the public health and furnish protection to property.*

*II. I shall consider that in performing this service I am required at all times to act within the bounds of local, state and national law and within the field of orderly procedure among free men.*

*III. I shall, therefore, extend my own fund of technical and professional information to the end that the procedures which I advocate are based upon well grounded information.*

*IV. I shall, in every legitimate manner, encourage the construction of water works structures, the use of materials or the practice of management or operating procedures which are economically sound and in the public interest.*

*V. I shall at all times discourage exaggerated, unfair or untrue statements concerning any operation or material connected with public water supply. In conformance with this principle, I shall endeavor to assist my associates as well as the public, to obtain a correct understanding of water works operations and materials.*

*VI. I shall not accept any remuneration or benefit from any interested party other than my employer or my client. Neither shall I accept any collateral employment which might in any degree affect my performance of my duties or obligations to my regular employer or client.*

*VII. If I have a financial or personal interest in inventions, apparatus or any device or procedure which may be offered for sale to or considered for purchase by my employer or my client, I will disclose that interest to him fully and will participate in no decision related to its purchase or use by that employer or client.*

*VIII. I hold to the opinion that honorable competition for advancement and for opportunity to render more responsible service is an essential part of democratic civilization — upon which rests real improvement and progress. But I shall not permit my own ambition for advancement to cause me to act unfairly toward others associated with me.*

*IX. I shall by all legitimate and reasonable means strive to improve the public appreciation of the services rendered by myself and my associates — to the end that employment in the public water supply field is recognized by all as a legitimate and lifetime career for well trained and industrious citizens.*

*X. I shall not, as an incident related to discussions of rates of pay or conditions of employment, suspend or fail to perform the duties entrusted to me, nor permit water service to fail the citizens who depend on me. I shall, having associated myself with public water supply operations, hold the public interest superior to my personal interests and I shall by my acts and by my leadership see to it that water service is maintained under both normal and emergency conditions.*

*In short, I understand my obligations to my community and having accepted responsibilities upon which depend public health and safety, I shall not fail.*

**(Adopted by Board of Directors — January 15, 1945)**

# LONG ISLAND OPERATORS HEAR ABOUT NEWEST ELECTRICAL EQUIPMENT

The Long Island Section of the N. Y. State Sewage Works Ass'n. met on Dec. 7th at Old Westbury, of polo fame, for one of its bi-monthly dinner meetings.

This being the annual business meeting of the Section, the election of officers resulted in a vote of appreciation to C. George Andersen, Supt. of Sewerage, Rockville Center, L. I., who serves the Section as Secy. and Treas. He was re-elected to this office which entails program arrangement and presiding at all meetings as well as the duties of Secy.-Treas. To the Executive Committee were elected—

W. Fred Welsh, Engr., Hempstead, L. I.

Alden W. Young, Supt., Riverhead, L. I.

Operators heard Frank Holland, Sewerage Commissioner of Freeport, L. I., tell why Commissioners should attend meetings of sewage works operators—principally, he said, to learn something about the problems of operators, and their needs, and to learn of new methods and what equipment might produce greater efficiency and probable economies. He urged members to get their bosses to these helpful meetings by whatever means it may take—but, get them out for the good of all concerned.

The first speaker was Frederick H. Franklin, Eng'r, Suffolk County, L. I., Planning Comm., who presented a report on sewage needs on Long Island as post-war projects, in which was given a preliminary outline of the extent of sewerage betterments and degree of sewage treatment being proposed for each community. The estimated total for Suffolk County is $11,000,000 which can be financed within the 10% debt limit should there be a 50% grant in the form of Federal Aid. A financing study is under way.

**Secy.-Treas.**
*C. Geo. Andersen*
*Sup't*
*Rockville Center*
*L. I.*

**Prin. Speaker**
*H. Vance Crawford*
*Engineer*
*Gen. Electric Co.*
*Schenectady*

H. Vance Crawford, who has charge of electrical equipment supplied water and sewage plants by General Electric Co., presented an illustrated review of what's newest in this field. Some of the high spots included the newest gas filled cable, kept under moisture-proof positive pressure automatically and cable troughs rather than conduits. The old vs. modern transformers was an eye-opener in respect to appearances, safety (no fencing in) and at lower cost to boot. Here is a product of the war at advantage. Dry type transformers for low voltage are decidedly new. He showed many pictures of 1944 streamlined control panels of the unit cell or segment type—compact, practical and attractive. A new type of reservoir or tank level control works on electronic principles and for sewage sumps pump control is effected by a heated floatless contact rod which throws the pump in when sewage rises around it and vice versa.

Mr. Crawford described improved explosion-proof switches and motors, also the submersible motor as a sewage plant unit of interest. Motors of vertical design have complete enclosures for starter button switch, etc.—can be backed up completely. Cable connections with nuts are simpler, more easily made or broken. He described and pictured unit space heaters, immersion heaters for water heating, "calrod" heating cable or tapes in 110 and 220 ft. lengths at 6 cts/ft. for various purposes.

One of the most interesting units pictured was the pocketsized edition of a portable welder self mounted on truck ready to wheel anywhere. This little general utility welder and cutter pulls only 60 amps, costs but $250, has many uses in plant maintenance, repairs, thawing, etc. It was a little gem, produced originally for airplane fabrication.

Another item of great interest was the converter for sending low voltage current constantly through idle motor windings to keep them warm and dry. [Note: Several of these newest units are to be more effectively described in the Equipment News Columns of future issues of *Water Works and Sewerage.*]

## 200 New Sewage Treatment Plants Ordered for Pennsylvania Municipalities

(*Just the Beginning in a Post-War Program for State-Wide Cleaner Pennsylvania Streams.*)

Just today "Water Works and Sewerage" has received a list of 200 Pennsylvania municipalities which have been ordered by the Pa. State Dept. of Health and the State Sanitary Water Board to provide for treatment of their sewage and submit plans for approval by a designated date. We are advised that this represents the first lot of orders and that all other Penna. municipalities are also being required to provide at least primary treatment of their sewage when and where the Dept. of Health concedes that primary treatment alone is adequate for conditions at hand.

Last summer the State Sanitary Water Board, (H. E. Moses, Chief Engr.) held a number of public hearings throughout the State, to which municipalities, industries and others interested were invited. Suitable publicity was given these hearings at which the Sanitary Water Board explained its stream clean-up program on a statewide basis, and set forth its policy of requiring at least primary treatment of all municipal sewage and the equivalent degree of treatment from industrial centers throughout the State.

The only exceptions made in this blanket program for cleaner Pennsylvania streams are those instances where the receiving streams are so heavily charged with acid mine drainage as to make it not in the public interest to require treatment of sewage on wastes at the present time.

Thus, all polluters were amply forwarned of the forthcoming orders which would specify the degree of treatment required and stipulate the date by which plans and specifications for the treatment plant must be submitted to the Sanitary Water Board or the State Health Dept.

To any or all who may be interested in the first list of 200 municipalities, and the official dealt with in each instance, copies are available for the asking—as will also be the case with future lists. For a copy of the No. 1 list of "Pennsylvania's 200" (this title being ours) just address the State Sanitary Water Board, Harrisburg, Pa.

### WITH APOLOGIES

It is with considerable regret that we must announce our inability to print the reports of the following meetings, earlier postponed.

**The Florida Section of AWWA.**
**The 4 States Section of AWWA.**
**The Virginia Section of AWWA.**
**The South Dakota Water & Sewerage Conf.**

Until such time as war-time restrictions on the use of print paper are eased, meetings reports must henceforth be sharply curtailed in order that better balanced issues may be produced and further criticism avoided.—L.H.E.

# CATHODIC PROTECTION OF STEEL SURFACES IN CONTACT WITH WATER

## Some Comments on the Practical Application of the Process

*(The Second of a Series of Articles)*

By LEE P. SUDRABIN
Chemical Engineer
ELECTRO RUST-PROOFING CO., INC.
DAYTON, OHIO

IN ORDER to mitigate the corrosion process of steel surfaces in contact with natural waters by cathodic protection, it has been shown in the first of this series of articles, which ran in the January, 1945, issue of this magazine, that, for each corrosion environment, a certain "minimum current density" must be projected from an auxiliary anode configuration through the water to the surface to be protected. The "minimum current density" required to stifle the local corrosion currents on steel surfaces in a natural water environment, is largely governed by the coloumb-second or ampere-hour effect occurring in the electrochemical reduction (a) of the dissolved oxygen reaching a unit area of the metal surface through the diffusion layer existing between the metal surface and the bulk of the water.

(a) $HOH + \frac{1}{2}O_2 + 2e \rightarrow 2OH^-$

From these principles previously discussed, it becomes apparent that the effectiveness of cathodic protection is independent of the source of the projected current so long as the amount is adequate.

### *Sources of Protective Current*

The flow of protective current may be motivated in one of two manners.

(1) Using a metal plate whose solution potential in the particular corrosion environment is greater (more anodic) than that of the metal to be protected, a protective current can be produced. The potential difference between the two metals in the corroding media results in the flow of current from the more anodic or sacrificial metal through the solution to the metal surface being protected, if an electric circuit is provided between the metal being protected and the anode. An example of this method of corrosion control, which may be better described by the term "Galvanic Protection" rather than "Cathodic Protection" is the use of zinc plates coupled to steel surfaces. Metals such as cadmium, aluminum, and magnesium have also been found to have a protective effect when coupled with iron. Another example whereby the potential difference between two metals may be used to protect the less anodic metal was illustrated by Davy[1] when he used iron, which in most environments is anodic to copper, as a sacrificial anode to protect the copper sheathing of ships in sea water. [We are all familiar with the phenomenon occurring when iron is coupled with copper in aerated waters. The iron immediately adjacent to the copper is usually severely attacked, with the degree of attack on the iron diminishing as the distance from the copper is increased.]

The Author

There are two main limitations in the use of zinc plates or some of the other more anodic metals for providing the necessary "protective current density" on steel surfaces. Reviewing the Electrochemical Equivalents of metals in the first article of this series, it was shown that at least 23.5 pounds of relatively expensive zinc would be consumed per ampere year if there were no other anodic processes occurring. This zinc consumption, resulting from a current flow of one ampere for one year to the steel surface, does not include the zinc loss occurring because of the local corrosion currents flowing over the zinc surface. In most cases, experience has shown that the cost of zinc plates, which serve both as an anode and a potential force, is prohibitive.

The shortcoming of this galvanic method is that the potential difference existing between the more anodic or sacrificial metal and the metal to be protected usually is not sufficient to overcome the resistance through the corroding media and suppy an adequate current density to completely stifle the corrosion currents over large areas. It has already been stated that the application of a current density below the "minimum protective current density" will give only partial protection. Because of the limited potential driving force available, complete protection usually extends only a few inches away from the zinc plates. Beyond the outer edge of the area, where complete protection is observed, the protective effect diminishes as the distance from the zinc increases because of the gradual decrease of the current density flowing to the surface of the metal being protected.

(2) The second, and most used method of projecting current flow from a properly designed auxiliary electrode configuration in the corroding media to the surfaces to be protected, is with an external potential force which can be regulated to drive the current required for protection.

The external potential force to be applied to the auxiliary anodes in the form of direct current can be developed by storage batteries, wet type rectifiers, dry type rectifiers, motor-generator sets, gas-engine generators and windmill generators.

Because of the conditions met in the practical application of cathodic protection, the equipment selected for this purpose should have the following characteristics: low initial cost, require very little maintenance, have a high efficiency in the conversion of energy to the proper direct current, be easily adjustable to meet potential and current requirements

of the corrosion control installation, be unaffected by weather and climate, attractive in appearance, operate continuously, etc.

### *Rectifiers*

The equipment most frequently selected for developing the external potential force for driving the current in the application of cathodic protection to pipelines and submerged steel structures is the dry type rectifier. There are three well developed dry type rectifiers commercially available at the present time. These are generally referred to as copper oxide, selenium, and copper sulphide rectifiers. These rectifiers are dependent upon the electrical check-valve properties of certain metals for converting alternating current to direct current. It has been found that the formation of copper oxide on one side of a copper disc of high purity, by controlled exposure to heat and air, creates a unique electrical check-valve property. By making an electrical contact to the metallic copper, and another through lead discs in contact with the copper oxide formed on the surface of the copper, it is observed that unidirectional current will encounter less resistance and flow more readily from the copper oxide film to the copper than in the reverse direction; i.e., from copper to copper oxide. Basically, the selenium and copper sulphide rectifiers function on the same principle as the copper oxide rectifier does. By using this check-valve property, rectifier stacks can be assembled for converting alternating current to unidirectional or direct current, using the full wave of the a-c cycle. Fig. 1 is a simple diagram to show the position of the rectifier stack in the electrical system used in converting A.C. to D.C. for cathodic protection.

A transformer having variable taps on the secondary winding is used to supply alternating current at the proper voltage for rectification. The a-c voltage applied to the rectifier stack is governed by the resistance to be overcome in the rectifier circuit and, more importantly, between the anodes and the surface being protected; so that an adequate current density is provided to stifle the corrosion currents on the steel in the particular environment being encountered.

Copper oxide rectifier stacks, which have been in continuous operation for more than fifteen years, are reported by the manufacturer to be functioning satisfactorily with very little drop in efficiency from that originally observed. The copper oxide and the selenium type rectifiers are somewhat more efficient in current conversion than are the copper sulphide rectifiers. Their overall efficiency, including the transformer when operating at rated capacity on full wave single phase rectification, is in the neighborhood of 55 to 65 per cent, depending on the particular characteristics of the rectifying unit assembly.

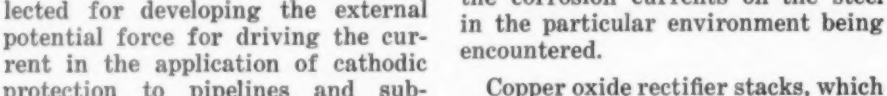



**Fig. 1—Diagram of Simplified Cathodic Protection Circuit Utilizing a Dry Type Rectifier.**

Over two thousand copper oxide rectifiers, some of which were installed more than six years ago, have been functioning continuously in normal operation with no breakdown of the rectifier stacks. Fig. 2 illustrates a typical rectifier assembly in a weather-proof housing, used in the application of cathodic protection to steel water tanks. Usually these rectifiers are cooled by natural convection of air over their cooling fins, although fans are sometimes used on larger capacity units to reduce the size and cost of the rectifiers.

### *Motor Generators*

Motor-generators[2] are frequently used in converting A.C. to D.C. of the proper characteristics for cathodic protection. They are most practical when the output requirements exceed 3,000 watts. Because of moving parts, motor-generator sets require considerable maintenance attention, and necessitate proper housing for protection from the elements. Motor-generators are usually more efficient than the dry type rectifiers, but their original cost is greater than that of a dry type rectifier of equal capacity.

### *Windmill and Engine Generators*

Windmill generators are sometimes used in pipeline protection where A.C. is not available. They are dependent on continuous wind velocities in excess of 5 mph. An electrical circuit has been designed[3] whereby storage batteries charged by a windmill generator may be used to provide current during periods of low or no-wind velocity.

Gas engine-generators,[2] taking gas as a fuel from the pipeline being protected, are being used on natural gas pipelines in regions where the wind velocity or constancy is not adequate for windmill generators and A.C. is not available for rectifiers. At sewage plants engine-generators may well be considered because of the availability of by-product fuel in ample quantity.

Storage batteries, except as a supplement to windmill generators, or the wet type rectifier, are rarely used in cathodic protection practice because of their low efficiencies and high maintenance costs.

### *Evaluating Protection:*

Evaluating the degree of protection being derived from any one of the four basic methods of corrosion control, including cathodic protection, is often complex, and such an evaluation should be made by a highly competent engineer experienced in corrosion.

One can be guided by the principles of the electrochemical corrosion mechanism for evaluating the effectiveness of cathodic protection, which was discussed in the article appearing in *Water Works and Sewerage* for January, 1945. There are two phenomena which in practice characterize the corrosion of steel in natural waters; namely, the wastage of metal usually evidenced in the form of pits and the coincidental formation of rust or tubercles.

It was noted that, in the corrosion process, iron atoms leave the crystal lattice of the metal surface and enter the natural water or other corroding media as ferrous ions. This process is physically shown by the development of pits on the localized anodic areas. The pitting type of attack is unfortunate, since many structures can no longer confine liquids when leaks develop even though more than 99 per cent of the original metal in the structure is sound and intact. On this ground,

it becomes evident that the rate of attack or pitting of steel in localized areas is often more important than the total amount of metal lost.

Rust and tubercles, the corrosion products familiar to everyone, are formed by the precipitation and oxidation of the ferrous ion introduced into the corroding media by the natural anodic processes occurring on the steel surface. This rust usually covers the pitted areas and is observed in many forms. In cases where the corrosion process is active, and is under oxygen control, a hydrated black ferri-ferrous oxide (magnetic in nature) is found in the bottom of the pits. As the outer surface of the corrosion nodule is reached, the dissolved oxygen in the water has converted the black magnetic iron oxide to the more highly oxidized form of iron, and is commonly seen as red rust or hydrated ferric oxide.

The volume of rust created by the corrosion process which covers the pitted areas cannot be used as a basis for estimating the depth and amount of pitting, because the volume of the corrosion product (in situ), is usually many times as great as that of the metal from which it was formed. The volume of the corrosion product is governed by the manner and the environment in which it was formed.

In general, the effectiveness of any method of corrosion control can be established by comparing the rate of metal wastage, indicated by metal thickness measurements or by weight loss over a definite period of time, when the corrosion control system is being used against the rate of metal wastage in the absence of the particular corrosion control method.

### *Determining the Effectiveness of Cathodic Protection*

Great care should be taken in the use of corrosion test specimens and interpretation of results therefrom, for evaluating the degree of protection being obtained. Unless the specimen is of the same metal, and has the identical surface condition found on the structure being protected, the same current density will not produce an identical protective effect on both surfaces. Secondary corrosion currents, resulting from the dissimilarity of the test specimen and the surface of the structure being protected, will lead to erroneous results often unfavorable to the method of corrosion control being applied.

Another condition to be met in the proper use of test specimens is that the specimens should receive the same current density as the wall being protected. This may be accomplished by coating one side of the specimen with wax and placing the waxed surface face against the wall. The author, in using this technique for current density distribution studies, found that the test specimen would receive within ten per cent the current density reaching an equal wall area having an approximately identical surface condition, providing the potential drop through the current measuring device was compensated for by an opposing potential. Test specimens are usually compared with unprotected specimens in the same environment on the weight loss basis, since the depth of pitting characteristics on test specimens (sometimes called coupons) are rarely comparable to those found on the submerged structure. Test specimens, positioned some distance from the wall of the structure, will usually receive a higher current density than an equal area on the wall. This is true particularly in water tanks. Although test specimens have many limitations, they are helpful in establishing a general picture of a particular corrosion phenomenon.

Measuring the depth of pits at intervals by means of a depth gage resting on corrosion-resistant permanently fixed pins, is one of the most satisfactory methods of establishing the degree of protection obtained, providing the cathodic film around the pit is not disturbed. By disturbing the cathodic layer of calcium carbonate, rust, etc., around the pits, a higher current density will be required to stifle further progress of the corrosion process. Therefore, if a corroded tank is cleaned a larger current input will be required in the early stages to stop the corrosion which would otherwise be accelerated.

Complete protection of a new uncorroded surface is established, if pitting or the accompanying formation of rust is not observed.

The formation of a white deposit consisting mainly of calcium carbonate on the metal surface by the application of cathodic protection is usually clear-cut evidence that the corrosion process has been stifled. The loosening of previously adherent rust and tubercules by the formation of alkali and/or the evolution of hydrogen gas between the rust and metal surface, when a current density greater than that required to reduce the dissolved oxygen reaching the metal surface is applied, also indicates protection. Often this old corrosion product will be loosened and then slough off the metal surface by its own weight. However, in the author's opinion, this rust layer, if it is continuous over the metal surface, is an effective cathodic layer and will decrease the current density requirements for complete protection. It is therefore a waste of effort and money to clean the walls of corroded tanks, etc., before applying cathodic protection.

"Null"[5] and other electrical methods[6] have been developed whereby changes in metal potential, meas-

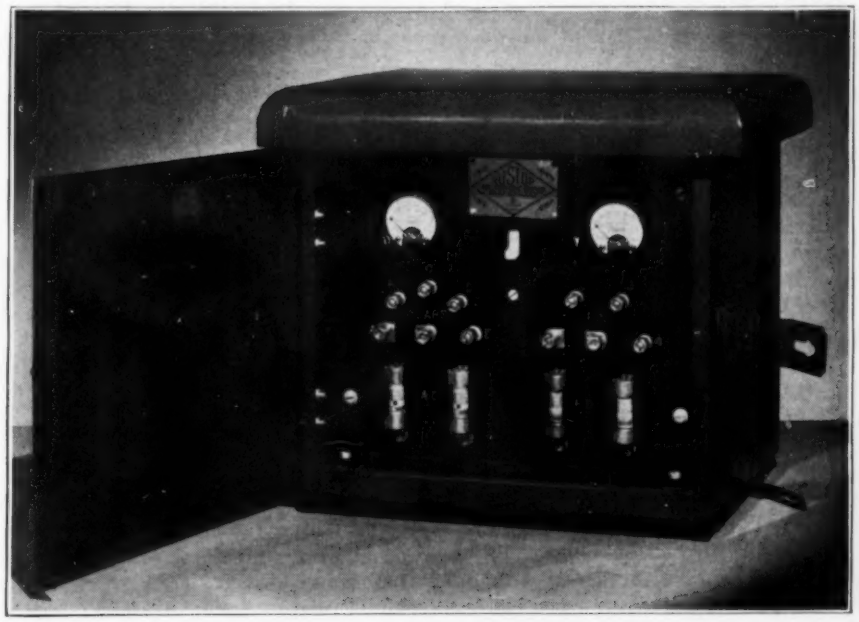


**Fig. 2—Copper Oxide Rectifier Used in Cathodic Protection of Water Tanks and Sewage Plant Equipment.**

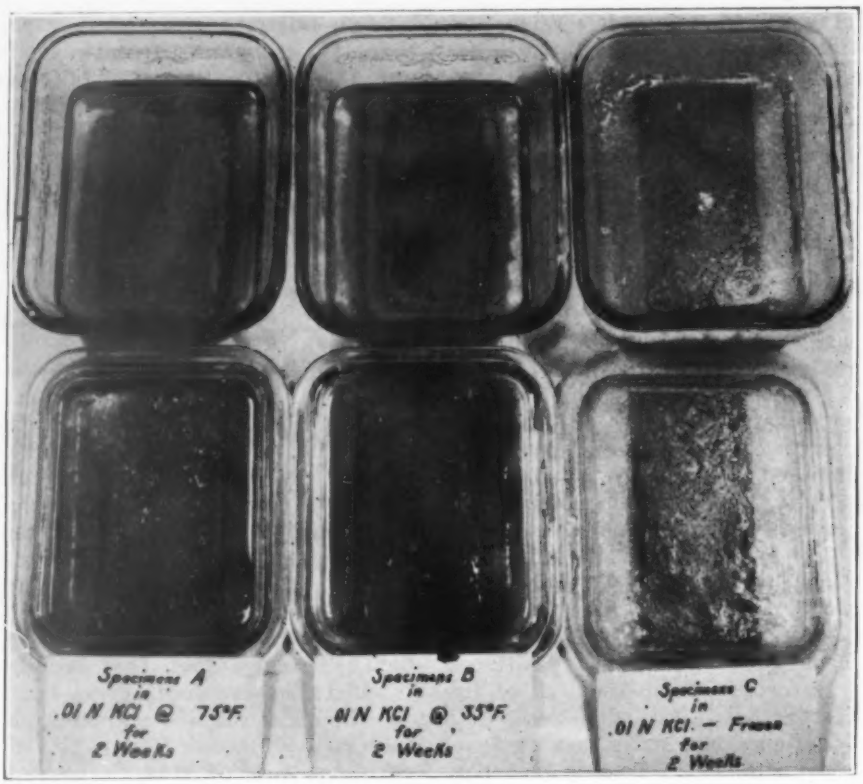



**Fig. 3—Test Specimens Used to Study the Rates of Corrosion of Steel at Low Temperatures and the Effects of Ice Coating in Excluding Oxygen and Elimination of Corrosion Behind Ice Formations in Elevated Tanks or Standpipes.**

ured against a standard reference cell with varying projected current densities, may be interpreted to indicate the "minimum current density" requirements for complete protection. Although these techniques are intricate, in recent years they have been widely used in evaluating current requirements for pipe-line protection.

Ewing[6] has found that applying a current density, sufficiently great so that an arbitrarily selected potential on a metal surface in respect to a reference electrode is reached, is not always a criteria of complete protection.

Cathodic protection cannot be expected to replace metal already lost by the pitting action or to cause rust formed before the application of cathodic protection to vanish. The main purpose of this method of corrosion control is to retard the rate of attack so that the useful life of the structure being protected will be extended beyond that which can be realized by other means of corrosion control. The reading of an ammeter on a rectifier should not be used as a criteria of protection.

In the protection of petroleum and natural gas pipelines, which have been installed for some time prior to the application of cathodic protection, a comparison of the leaks found each year before treatment against the number occurring after cathodic protection is applied has provided a very satisfactory way in establishing the value of cathodic protection.

### *Water Tanks*

In tentative specifications on the maintenance of elevated steel tanks and other water storage tanks, prepared by a committee of the A.W.W.A. in 1943, it is stated, "Experience has shown that, in practically all cases, the inside surfaces of a water storage tank are in worse condition than the outside. Almost without exception, tank bottoms which have had to be replaced on account of leaks through the steel, have corroded through from the inside." From these statements it is apparent that the inner submerged surfaces will demand greater attention insofar as corrosion control is concerned than the outside. It has been the author's experience in examining many tanks that the bowls of elevated tanks and the floors of standpipes are usually attacked much more severely than the vertical walls are. This may be accounted for by the localization of attack on areas under insoluble suspended matter which has settled on the horizontal or inclined surfaces of the tank. For example a leaf covering an area on the floor will cause pitting underneath it, since the leaf masks this area from the dissolved oxygen in the water. The areas around the leaf will be more accessible to the dissolved oxygen in the water and will become the cathode, of the oxygen differential concentration corrosion cell, where the depolarizing process controlling the rate of corrosion will take place. Unrelieved stresses resulting from the fabrication of the floor plates may also cause corrosion cells.

For more than eight years cathodic protection has been extensively applied in the mitigation of corrosion of tank surfaces in contact with corrosive waters. Experience and considerable fundamental research conducted during this period has shown that the mere installation of an anode from which current flows according to an arbitrarily chosen fixed current density constant usually will not provide satisfactory protection. In each tank the corrosion problem is unique and the engineering design of a proper cathodic system demands an accurate interpretation of the corrosion environment. Some of the fundamental factors influencing current density requirements and anode design are discussed in the first article of this series—see January, 1945, W. W. & S.

### *Some Case Histories*

A practical example of the effectiveness of cathodic protection is illustrated by an installation in a 100,000 gallon elevated tank with an ellipsoidal bottom in Dayton, Ohio, which was built in 1931. The tank was initially painted with one shop coat of red lead and then covered with a field coat of red lead after erection. The tank water level was automatically maintained with a fluctuation of about two feet between high and low water. In 1939 several leaks developed in the bowl of the tank resulting in the need for immediate repair. The leaks and most of the pit depressions were repaired by welding. The AWWA specifications[7] previously mentioned state that "Such a leak indicates that the entire bottom may be thin and other leaks may soon appear. The use of welding to patch such leaks is of very doubtful economy as the heat of welding very often is the cause of new leaks. Even if a considerable area is welded, it may be but a short time after such repairs are made before new leaks appear."

After repairing the tank bowl in 1939 a cathodic protection system was designed and installed in this tank. An examination of the tank bowl, vertical walls and riser, in the summer of 1944, showed these sur-

faces to be in very good condition and that the tank should serve without further repair for many years. This particular corrosion problem was extremely interesting since the water confined was from a deep well source containing very little dissolved oxygen and apparently having salts in amounts characteristic of the deep well waters in this midwestern area. However, the dissolved oxygen concentration in the bowl of the tank increased because of contact with the air surface, as will be noted in the analysis below:

Deep Well Water "A"

| | |
|---|---|
| $SiO_2$ | 21 p.p.m. |
| Ca (Calcium) | 93 p.p.m. |
| Mg (Magnesium) | 31 p.p.m. |
| Na (Sodium) | 9 p.p.m. |
| Bicarbonate alk. | 337 p.p.m. |
| $SO_4$ (Sulphate) | 72 p.p.m. |
| Cl (Chloride) | 20 p.p.m. |
| Total Hardness as $CaCO_3$ | 360 p.p.m. |
| pH | 7.3 p.p.m. |
| Dissolved $O_2$ in well water | .28 c.c./liter |
| Dissolved $O_2$ in water in bowl of tank | 3.6 c.c./liter |

A relatively low current density in this case proved to be adequate in retarding the progress of further corrosion and to form a white deposit on the submerged metal surface through the interaction of the $Ca(HCO_3)_2$ in the bulk of the water with the highly alkaline layer on the metal surface produced by the ordered reduction of the hydrogen ions and the dissolved oxygen reaching the metal surface by the protective current flow. Because of the absence of appreciable amounts of incrusting salts in some waters, a higher current density would be required than was applied in the previously described case.

The dissolved oxygen concentration usually is not uniform throughout a tank. Studies made by the author on many tanks has generally indicated that with water supplied containing a low dissolved oxygen concentration, the concentration of dissolved oxygen in the tank will decrease with the depth from the surface, whereas in tanks supplied with water having a high dissolved oxygen concentration, the oxygen concentration will increase with the depth from the surface. This variation in oxygen concentration may affect the intensity of corrosion in the tank at different depths and will affect the current density requirements for complete corrosion control on these areas.

There are three factors which govern the dissolved oxygen content in the water throughout the tank and probably account for the above observations.

1. Oxygen from the air will tend to enter the water through the water surface-air interface.[8] The amount of oxygen dissolved will be governed by surface area, temperature, movement of the bulk of the water, the oxygen already in the water, etc.

2. Oxygen already in the water will be consumed by the corrosion current or if cathodic protection is applied by the projected current, i.e., reduction of the $O_2$ reaching the metal surface to hydroxyl ions according to the reaction shown early in this article. Aerobic micro-organisms in the water will tend to consume dissolved oxygen. This behavior of the micro-organisms has been demonstrated by the absence of dissolved oxygen in sea water[9] at great depths and in the far ends of water distribution mains.

3. The other factor governing the variation of the dissolved oxygen concentration throughout the tank is the displacement phenomenon which occurs when water enters or leaves a tank. On a humid summer morning one will note, as water is being pumped into the tank, the formation of a distinct boundary ring below which condensation occurs. This ring creeps up the tank wall as the tank is being filled, indicating a distinct line of demarcation between the bulk of the water already in the tank and the cooler incoming water. The author has observed this phenomenon on the risers of elevated tanks and on the walls of standpipes whose diameters have often exceeded 100 feet.

In some cases where the incoming water is very corrosive because of a high oxygen concentration, anodes should be provided in elevated tanks to protect the riser. The author in the first article of this series has shown data indicating that only a very small current density would reach the riser walls from anodes suspended in the bowl of the tank. An anode extending the full length of the riser is often required to satisfactorily protect the riser.

A great deal of emphasis is usually placed upon the corrosion occurring on the intermittently submerged surfaces of a tank. Studies made by the author on a midwestern elevated tank indicate that cathodic protection will cause deposition of $CaCO_3$ and/or $Mg(OH)_2$ on these surfaces during submergence and that this deposit will effectively protect the surface during the period of atmospheric exposure.[4] In waters from which it is difficult to deposit protective scale forming salts, protection will be obtained only when the surface is submerged and an adequate current density reaches the area. On reexposure to air in the

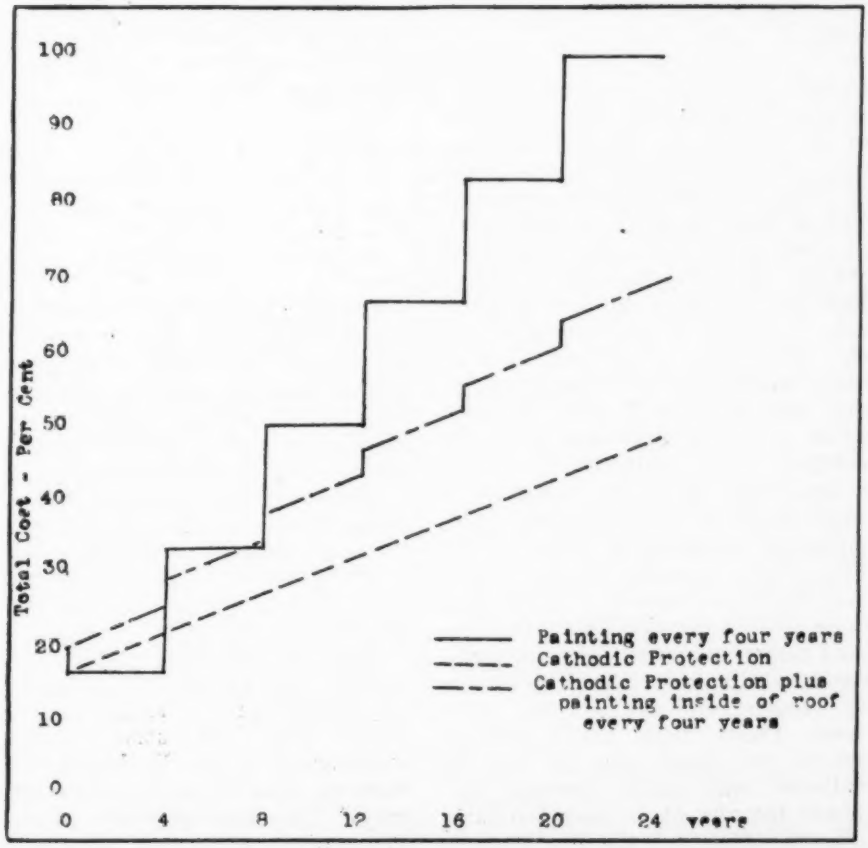



Fig. 4—A Comparison of Overall Costs of Cathodic Protection vs. Painting of Interior Tank Surfaces During a 24-Year Period.

absence of an insoluble salt coating corrosion can proceed. However, the corrosion rate during the period of exposure to air is usually negligible compared to that which would occur if the area is submerged in the absence of cathodic protection. In practice it is recommended that the inside of the roof and the wall of the tank be painted down to the mean water level when cathodic protection is applied. The author has already stated that attack on the floor of a tank is usually more severe than that found on the intermittently exposed surfaces of the tank. Therefore, any effective cathodic system must be designed and operated so as to insure maximum protection for the tank bottom and riser pipe.

### *Ice Interference*

In the engineering design of a cathodic protection system some consideration must be given to the formation of ice within water storage tanks and other submerged structures. Ice formation in water tanks is commonly found along the northern fringe of the United States and in Canada where the mean temperature is far below freezing for many months. This ice generally starts to form on the submerged walls of the tank and finally bridges across the surface of the water. Peak thicknesses of 7 to 8 ft. of ice along the tank wall have been reported in Montreal,[10] although thicknesses of 1 to 3 ft. are more common in the United States. The formation of ice in tanks is influenced by the mean temperature outside, frequency of water change in tank, temperature of water in supply system, heat dissipating surface area vs. tank volume relationship, tank covering, location insofar as wind protection, etc. A change in any one or all of the previously mentioned factors may account for formation of ice in one tank, whereas a short distance away in another tank little or no ice formation is encountered.

When the ice formation begins to melt, its behavior is not predictable. Often in breaking up, cakes of ice drop from the walls into the water, sink deeply and then float to the surface. In some cases the intact ice wall may ride up and down the inner tank wall like a piston with changes in temperature and of the water level. Cases have been reported where the upper edge of the ice cylinder will extend several feet above the rim of an open top tank. The movement of the ice tends to scrape the inner wall of the tank, scoring any protective coating. The scoring of a paint film will tend to hasten corrosion and require yearly patch paint application for satisfactory protection. This painting must be done as soon as the ice has melted since the most rapid corrosion on the exposed areas will usually occur during the summer.

Since it is common practice to suspend the anodes used in the application of cathodic protection to water tanks from supports above the surface of the water, it becomes evident that the shifting of ice in the tank may in some cases break or bend the anode assembly.

Much thought has been given to the most satisfactory procedure in applying cathodic protection where ice is prevalent.

### *Temperature and Corrosion Rates*

A study of the influence of the formation of ice upon the corrosion rate of steel is most helpful in establishing the need for cathodic protection during the freezing period. In order to demonstrate this, the author placed two weighed hot rolled steel specimens 4″x2″x1/16″ in a .01N KCl solution at 75° F., 35° F. and frozen in the solution respectively for two weeks. Fig. 3 reveals the results.

The .01N KCl (potassium chloride) solution used in this study being in contact with air, was extremely corrosive. The weight losses of the two specimens under each of the three conditions of temperature noted above are as follows:

| Specimens | Original Wt. | Final Wt. | Weight Loss | Temperature |
|---|---|---|---|---|
| A-12 | 60.1546 grams | 59.9557 grams | 0.1689 grams | 75° F. |
| A-13 | 60.1574 grams | 60.0009 grams | 0.1565 grams | 75° F. |
| B-14 | 60.6673 grams | 60.5576 grams | 0.1097 grams | 35° F. |
| B-15 | 60.5917 grams | 60.4836 grams | 0.1081 grams | 35° F. |
| C-16 | 60.3867 grams | 60.3865 grams | 0.0002 grams | Frozen |
| C-17 | 60.1246 grams | 60.1240 grams | 0.0006 grams | Frozen |

The rust formed by the attack on specimens A and B may be noted by the presence of nodules of corrosion product along the edges of the specimens and the dark precipitate lying on the bottom of the glass vessels. The uneven surface of the ice accounts for the shadows showing on specimens C. Specimens C were quick frozen in the .01N KCl solution and no corrosion product was noted at the end of the two week test period.

Even though the solubility of oxygen from the air was greater in the solution around specimens B at 35° F. than in the solution around specimens A at 75° F. the corrosion rate was greater on the latter specimens. This illustrates the influence of the temperature upon the effective thickness of the diffusion layer and the corrosion rate. Speller[11] has shown that the corrosion rate in an air saturated solution increases with temperature up to about 80° C. Above this temperature the reduction of oxygen solubility in an open top vessel with increasing temperature, becomes more apparent in its effect in the reduction of the corrosion rate, so that at the boiling point the corrosion rate is essentially zero.

The extremely high electrical resistance of ice, and its low fluidity which retards oxygen diffusion, results in a very low rate of corrosion attack of the steel coated with ice. From the demonstration it may be concluded that the progress of corrosion is negligible when the submerged surfaces of a steel structure are covered with ice.

In practice this is helpful since the anodes can be removed just before ice forms and reinstalled as soon as the ice melts to provide protection during the period that the metal is in contact with a corrosive water.

In order to eliminate anode removal and replacement each year, heated anodes are being considered along with anodes supported from the floor of the tank below the ice. However, the use of these ideas are governed by peculiarities of the ice formation and operation of each tank.

### *Economic Considerations:*

The prime purpose of any method of corrosion control, is to obtain the maximum useful life and the most satisfactory service from the structure being protected at the lowest overall cost. Failure to properly protect the submerged surfaces of a structure, such as a water tank, will in many cases result in a much greater depreciation rate of the tank than was anticipated at the time it was purchased. The financing and operating problems incurred by the need for early replacement or repair of the tank structure should be guarded against by a planned tank protection program.

The need for a planned corrosion control program applied to water storage tanks, is illustrated by a statement found in an AWWA Committee Report[7] "Such a leak may ordinarily exist only in the case of a very old tank or one which has not been cleaned or painted on the in-

side for about twenty years . . ." The author has previously discussed a tank which had leaks developing within eight years after erection. Other tanks, which are unprotected, depending upon the corrosion environment and operating conditions, may operate for more than twenty years without the development of leaks.

With a soundly planned corrosion control program, the life of a water storage tank should be extended to at least fifty years and even longer. Although there are always exceptions, it may be assumed generally that the depreciation rate of a water storage tank structure will be reduced from around five per cent a year to less than two per cent a year by the use of an adequate corrosion control program.

In comparing the cost of painting the inside of a tank against the cost of cathodic protection, certain basic principles should be borne in mind.

(1) Since a properly designed cathodic system will give complete protection of the submerged surfaces, its cost should be compared only against a painting cost in which the best type and grade of materials, labor and technique are used. This should include: the proper cleaning of the surface by wire brushing, sand blasting or flaming before paint application; the best grade of red lead and cover coat paint; adequate drying time between the application of the first and second coats and the filling of the tank with water; and the proper application of the paint by a reliable painter. The protective value derived from a paint coating applied to an improperly cleaned and prepared surface or the use of substandard grade paint and labor will not justify the expenses incurred.

(2) If paint is used it is recommended that the tank interior be examined annually,[13] particularly where ice formation is found, and any areas where failures have occurred in the paint film should be patched. Finally when the paint film has generally deteriorated the entire surface should be properly conditioned and repainted. Experience of the tank manufacturers[14] has shown that repainting is usually necessary every three to five years.

(3) Since the original cost of a cathodic protection system includes equipment such as a rectifier, wiring and other appurtenances whose estimated life is twenty-five years, any comparison of total cost of cathodic protection against painting should extend over this 25-year period. Experience during the past nine years has shown that the maintenance and operating costs of a cathodic protection system on water tanks, including anode replacements and labor and power, rarely exceeds eight per cent of the original cost annually.

J. M. Perryman[12] has prepared valuable data which establishes a basis for estimating the cost of protecting steel tanks by various methods. In estimating painting costs he has developed a chart showing the gallons of paint required to cover the inside and outside surfaces of tanks of various sizes and uses a factor of four times the cost of the paint to be added to that of the paint in order to cover the cost of labor, a nominal amount of wire bushing, scaffolding, etc. The cost of applying two coats of paint to the inside of the tank is about equal to the cost of a cathodic protection system. However when cathodic protection is applied, the cost of painting the inside of the roof of the tank and the side wall down to the mean water level, should be added to the cost of the cathodic protection system. In many cases the inside surfaces above the mean water level have been painted without emptying the tank.

Since price structures change from time to time, the author has prepared Fig. 4 to illustrate the basic factors previously discussed which are involved in the comparison of the overall costs of protecting water tanks for a period of twenty-four years. The relative cost of painting every four years against the cost of cathodic protection is shown in terms of per cent, the cost of painting being 100%.

Since cathodic protection can be installed and maintained in service without draining the tank, a condition which is necessary when paint is applied, the risk of being out of water in event of a fire or during peak load demand, is eliminated. This advantage has not been evaluated but it can be visualized that under some circumstances the cost of a cathodic protection system can be paid for many times because the tank has remained in service during an emergency.

Another factor to be considered is that a paint film is not completely effective as a corrosion barrier during all the period between paintings. As time goes by, the paint film begins to fail so that at the end of three to five years a measurable amount of attack has occurred at the points where film has failed. On the other hand the effectiveness of cathodic protection is continuous so long as the equipment is properly maintained.

### The Cover Picture

For the cover of this issue a picture has been taken from our files which was first used to illustrate an article in the Nov., 1939 issue of *Water Works and Sewerage*. The article discribed the new 1.5 M.G. elevated tank of the Indianapolis Water Co. which was conspicuous in that year because of the several novel design features contained.

Amongst the innovations of the day was the decision of Indianapolis Water Co. engineers to put to trial the then comparatively new cathodic-protection against interior corrosion. In this trial the decision was made not to paint the tank interior below the anticipated mean low water elevation, depending upon the electrolytic method alone for underwater protection, and paint for roof and upper inside wall protection—and exterior protection, of course.

This Indianapolis tank picture was selected for the reason that to our knowledge it represented the first instance wherein cathodic protection was substituted for paint protection in new tank fabrication and erection. In consequence it has been carefully watched.

Now, after 5½ years of experience—and observation, the 1939 judgement of Indianapolis Water Co. engineers has been shown to be sound and "cathodization," even in the absence of an initial under-water paint coat, has proved meritorious as a dependable protective process when properly designed and operated. —L. H. E.

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# WATER METERS

## Test, and Repair Procedures, With Some Comments on Performance Characteristics

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THERE have been dozens—maybe hundreds—of discussions, papers, speeches, or just plain arguments, on the subject of meter performance, and test and repair procedures for water meters and, although the minor points may be subject to disagreement, the main or important issues have been agreed on unanimously.

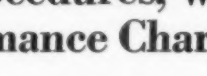
### *Types of Meters*

The different types of water meters, manufactured and extensively used in this country, may be listed in relation to the different measuring elements, each of which performs the same function of moving so many times through its cycle for a certain volume of water passing, or one might say the displacement of a certain volume of water for each particular movement.

The disc type meter is probably the best known, because this type is manufactured by eight companies, all of which have a sales force in the field. This nutating disc type meter has probably been cussed and discussed so much that one is apt to forget there may be other types, equally as good, including the oscillating piston meter, the flow or propeller meter, and the latest addition, the rotating screw type meter.

### *Why Buy Meters?*

When we stop to consider that, even though water is free, someone must pay for the service of supplying that water to the consumer, then we know why a water utility should buy meters. We know that that service may include securing the supply, pumping, filtering, softening if necessary, removing tastes and odors, disinfection, delivery of the water to the consumers' taps, all of which requires labor and expenditures. We know, too, that an office for billing and collecting, for meter repair, adds further expense, and some profit on the investment must be made. All of this expenditure to maintain the service must be compensated for by the consumer and it is through a meter that the consumer pays the just costs of this service.



The Author

Every gallon of water entering the distribution system carries a percentage of these service costs, and every gallon of water wasted will only add to the service costs of those gallons that are sold. This consideration is basic. Now, when wastage reaches the point where that sold will not carry the cost of service, then increased rates or taxation must result, unless meters are used to increase revenue by cutting down that waste.

Metered water is paid for by the consumer on the basis of usage and that usage will be properly measured *if* the water meters receive enough attention to keep them operating properly.

### *Meter Performance*

What does the water works profession expect in the nature of performance by water meters? According to the proposed AWWA specifications, a new ⅝x¾-in. meter should measure at least 95 per cent of all flow at rates of ¼ gpm., and at rates of from one to 20 gpm. the accuracy should not vary more than 1½ per cent in either direction (i.e., from 98.5 to 101.5 per cent).

Water utilities have been receiving meters that meet these specifications for several years. But, regardless of original performance characteristics, no meter will maintain its accuracy except under ideal operating conditions, and ideal operating conditions do not include the measurement of sand, silt or other foreign matter. Corrosive water likewise is not conducive to ideal operating conditions.

Chemical or electrolytic action on meters destroys their accuracy, but this problem cannot be met by the manufacturer, as it is a local problem subject to correction by the water utility. Careful control of local operating conditions is the only manner in which good meter performance can be maintained.

### *Proper Meter Installation*

Proper meter installation is simple but the rules should be adhered to strictly. The principal rules for installation may be summed up in the following five points:

1. Be sure that the meter is the right size for the work it has to do. An over-speeded meter, or one too small, will require frequent trips to the shop. A meter too large will lose many dollars in revenue on low flows.

While meters have maximum rated capacities, they should be used at this peak load capacity for only short periods of time. For continuous operation the AWWA recommends an operating rate at only one-fifth of maximum rated capacity. These factors should be helpful in the choice of the proper meter size.

2. Flush the service line before the meter is installed. This will remove small particles of foreign matter that are often present and that are sure to be forced into the meter when the service is turned on.

3. To obtain the best results, always install meters in the vertical position in accordance with their design.

4. Be sure that pipe strains and improper fitting do not throw unnecessary strains on the meter.

5. When making a connection, never use red or white lead or other pipe compound on female threads. Always use pipe compound on the male or external threads so that it will not be forced inside the piping. Failure to observe this rule is a frequent cause of meter stoppage.

### *Meter Testing and Calibration*

Every meter shop should have facilities for testing meters which are taken out of service for stoppage or repair. The equipment does not have to be elaborate. In a small shop, the

[*Note: This paper is based on a talk made by the author before the Penna. Water Operators Ass'n at Columbia, Pa.—Ed.*]

only item needed is a calibrated can or tank which holds either one cubic foot or ten gallons, depending on the units in which the meter measures the flow.

Meter couplings screwed into the proper sized pipe coupling make it possible to test several meters at the same time. The only precautions necessary are valves on the inlet and outlet, and the elevation of the final discharge into the tank to a height that insures that all meters are full and not operating partly on air. Inexpensive orifice plates, on the outlet side of the meter, may be used as a simple but less dependable means of checking the accuracy of the meter.

Opinions differ as to the proper flow for calibration of a ⅝-in. or ⅝x¾-in. meter. Considering the fact that surveys indicate that 20 to 30 per cent of household water is drawn at the rate of 1 gal. per min. or less and 10 to 12 per cent at ¼ gpm. or less, the answer seems simple: Regardless of what other rates are used in testing, test all such meters, whether new or repaired, at ¼ gpm. *for one complete revolution of the test hand.*

The surveys also show that 55 to 65 per cent of the total domestic water used is drawn at flows between one and six gal. per min., and the balance is used at rates under 12 gpm. Therefore, tests at maximum rated capacity are not necessary, inasmuch as the meter seldom operates at that rate.

The purpose in calibrating a water meter is to assure that it will account for very close to 100 per cent of the water that passes through it. Therefore, it is essential to determine the performance curve or accuracy of the meter at the flow rates at which it will operate the greater part of the time. As indicated above, the flow rate between one and 12 gpm. is important.

Meters quite generally have a point of high registration, usually between one and three gal. per min., but from four to 12 gpm. the registration efficiency curve is practically a straight line. The point of maximum registration moves up or down the curve, depending on the sensitivity of the meter. In short, a meter sensitive to low flows will have a high registration at about one gal. per min., whereas meters not so sensitive will have the high point of registration at about 2½ gpm. Thus it is well to test for medium flow rates at approximately two gal. per min. Full flow tests may be made at from 10 to 14 gpm., as the curve shows little divergence from a straight line.

The variation in accuracy of a meter between 1 and 14 gpm. is called the *spread.* In most good disc meters this spread is not more than 2½ per cent; in many, it is not more than 1½ per cent. Whether the meter can be set to average 100 per cent registration depends on the meter itself. Sometimes operating conditions make a meter run fast. The per cent build-up in a meter's registration depends entirely on the clearance or fit of the measuring element in the measuring chamber.

Where meter registrations build up, experiment in the local shop must determine the means of adjusting for the condition which is often caused by the nature of the water being measured. Otherwise, a setting on full fast flow of 99 per cent registration accuracy will usually average 100 per cent on the variable flows. On the minimum or sensitive flow a meter should test at least 95 per cent registration accuracy, and it will pay dividends if time is taken to run one full revolution of the register at this rate.

The writer favors the volumetric method of testing and does not favor the use of special high-speed test clocks. When a meter is tested, the clock and change gears of the particular meter should also be tested. The writer also favors the sweep hand or large test hand clock, not only because it gives a more accurate test reading but in service it also acts as a good leak detector when all house taps are supposed to be closed. With it the householder can be easily shown when leaks are occurring.

### *Meter Repair*

Repair procedures for water meters should be the same, regardless of the size of the system or the number of meters serviced. There are five points to be kept in mind in regard to meter repair.

1. Keep ample and sufficient records on all meters in order that you may know what is happening on the system. This means a complete record on each meter when purchased, size, type, accuracy when new, accuracy before and after each test, total water registered, reason for each repair, notations of worn or defective parts, and so forth.

By using a good cross-index file on reasons for repairs it will be possible to have a complete check on the major meter troubles. Such a file will tell whether it is foreign matter, hot water, or inherent weakness of some particular part of the meter. With such knowledge, steps can be taken to improve operating conditions to eliminate the trouble, or assistance from the manufacturer may be obtained.

2. Always test each meter under operating conditions, both before and after the repair. Before, to help locate the difficulty; and, after, to insure that the difficulty has been remedied.

3. After the meter is taken apart, all parts should be thoroughly cleaned and inspected to determine if each part is proper for reassembly. This cleaning may be accomplished in several ways but it is not good policy to acid dip the measuring chamber. Rather, it should be scrubbed with soap and hot water so as not to disturb any protective coatings thereon.

4. There are three parts of a meter that should receive especial attention by a man well qualified in that work.

A. The clock or register—Thoroughly check for fitness and replace if doubtful. (The doubtful register or clock may be repaired later if possible.)

B. The gear train, whether oil encased or open.—Thoroughly check for fitness and replace if doubtful. Oil-enclosed gear trains must be emptied, washed, inspected and, if fit, repacked with fresh grease of the proper type furnished by the manufacturer.

C. The measuring element.—Use great care with this assembly, as it is the most important part, whether disc or piston type. The use of fancy gages for repairing these parts is not necessary. Feeler gages with points cut down to ⅛-in. in width work well in determining the clearances necessary.

In both disc and oscillating piston type meters the clearance between the outside diameter of the disc or piston and the chamber wall is important to the accuracy of the meter. If high accuracy at ¼ gpm. flow is specified, it often is necessary to reduce the normal clearance. While the manufacturer can do this, it may cause added trouble if the water in the system is not good clean water free from sediment or encrusting constituents.

Likewise, where water temperatures show wide variations, it will not pay to fit the disc or piston too close. In these cases 0.004 to 0.005-in. between the measuring element and the chamber wall will be sufficiently close; whereas, in the absence of foreign matter and radical temperature change, the clearance may be reduced to 0.0025 to 0.003 in.

The side wall of the chamber and the outside of the disc do not usually require much attention, inasmuch as they do not touch unless the ball or ball seat becomes worn. This usually requires a long time, but such wear can be checked easily by feel or feelers. To prevent such wear in the ball-socket from causing wear of the side wall, the half balls may be shimmed up with paper shims or by loosening the balls and giving them a half turn. Normal clearance at this point is 0.002 in.

The most troublesome part of the chamber seems to be the thrust roller. Either the head of the roller wears, causing a by-pass around the chamber slot, or the slot itself wears until there is no choice but to scrap the chamber. Lining the slot with a removable liner on one side has not been too satisfactory. It is better to use a reinforced disc and eliminate this source of continual trouble.

The fit of the disc spindle around the control roller is likewise important. The function of the control roller is to keep the flat side of the disc from coming in contact with the conical top and bottom parts of the chamber, although the separation is but a few thousandths of an inch. At high speed, the disc naturally lies down in the proper position, but at slow speeds it tends to straighten up and allow a bypass under the flat side of the disc. Therefore, if the roller is badly worn, the clearance under the disc may be too great and thus excessive by-passing will occur.

The problem in refitting the piston in oscillating piston type meters is quite similar to that above. Clearances must be checked and fitting done with care. The fit desired will depend on local conditions, amount of foreign matter to be expected and temperature range of the water. The up and down play of the piston can be adjusted by noting where the wear predominates and by rubbing a few thousandths of an inch from the top or bottom plate, thus allowing the plates to drop in closer to the piston. When such a procedure is followed, it must be done with care and some means (usually a micrometer) must be used for measuring the amount of material taken off.

### *Final Steps*

Re-assembly of the meters, followed by careful testing, must follow the repair operations. Clocks are then set at zero and the meter painted with bronze paint. This final finish is important, for it proves to the customer that the meter has been overhauled and is in good condition. It is never advisable to reinstall a meter that has a dirty or old appearance, for a new looking meter improves customer relations.

While waiting to be installed, meters should be put in stock on shelves. If the oil-encased type, meters should be stored upside down to guard against the grease seeping out of the gear train and into the measuring chamber.

One word, in closing, a water utility cannot give its meters too much attention; for, as someone else has said, "As your meters go, so goes your revenue!"

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# CLEANING METER CASINGS BY SAND BLASTING*

**A description of the Akron Sandblaster appeared in Water Works and Sewerage some time ago but its successful and continued use for more than five years makes it well worth reprinting.—Ed.**

THE use of sand blasting instead of acid dipping for cleaning meter casings being desirable, it was necessary to develop a chamber that can be used in the meter repair shop so that the work may be done without subjecting the men to silicosis. The illustration is a diagrammatic sketch of the chamber developed by the Bureau.

The meter is placed on the notched revolving table and revolved by inserting the end of the blast gun in the notches. As there is some play in the hole through which the blast gun enters the box, a vertical strip 2 inches wide may be cleaned before it is necessary to revolve the table.

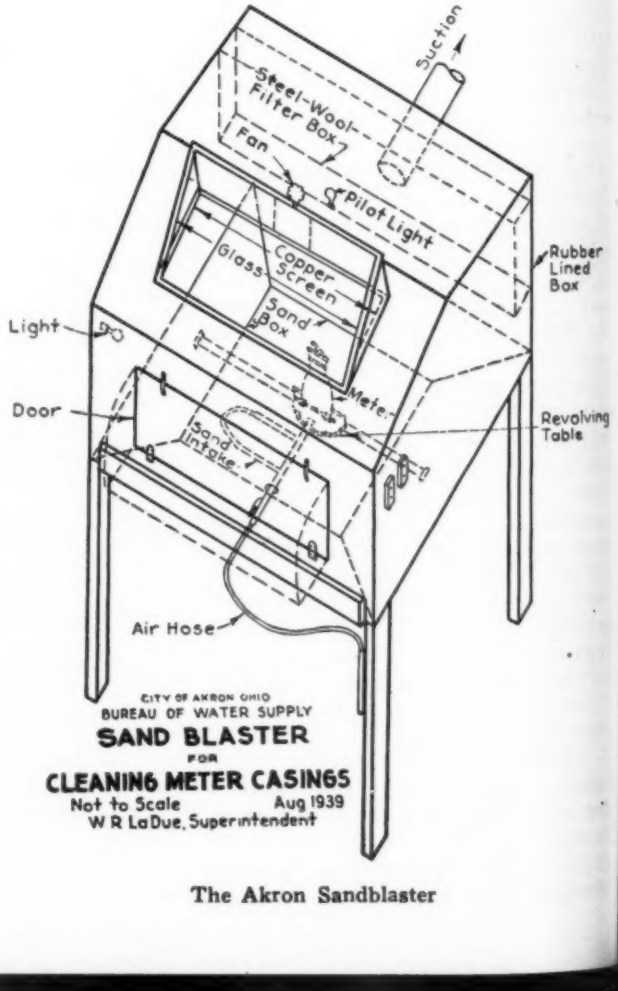
The registers are removed before the casing is placed in the blaster and the bonnet glass and threads on the inlet and outlet are covered; thus no sand enters the casing and the glass is not etched. The cleaning of a ⅝-inch meter requires about three minutes.

The operator looks through the glass window, the glass being protected by a fine mesh brass screen which keeps sand from etching it. He can see his work at all times while blasting, as the inside of the box is lighted.

The sand placed in the bottom of the blaster is drawn up by the blast gun, which is really a water siphon. In changing this water siphon to a sand blast gun, the designers have worked up a jet that can stand the brunt of sand passing through the nozzle with very little wear, even though the sand travels under 60 or 70 pounds air pressure.

The box is kept free from dust by a suction fan. The suction to the fan passes through steel wool that screens out the coarse sand particles, which drop to the bottom of the blaster and are used over again.

After meters are blasted, they are given a coat of clear lacquer, which gives all meters a uniform finish. Bottoms are painted black.




The Akron Sandblaster

*Contributed by W. R. La Due, Superintendent, Bureau of Water and Sewerage, Akron, Ohio.

# UPRATING DISTRIBUTION SYSTEMS BY CLEANING AND CEMENT LINING*

By J. A. FRANK
Engineer
NATIONAL WATER MAIN CLEANING CO.,
NEW YORK, N. Y.

BECAUSE wartime restrictions on men and material make the laying of new mains extremely difficult, the rehabilitation of distribution systems by cleaning and lining is being practiced as the least expensive and quickest method of obtaining additional capacity. In so doing the useful life of the rehabilitated main is extended many years, and the recovered capacity is assured of being sustained therewith.

There are many improved practices in both cleaning and cement lining and, with proper scheduling, work can be done much more quickly than in earlier years.

### *Some Modern Practices*

The cutting of cast-iron pipe has long been a laborious, tricky and uncertain job and there is a decided trend toward the use of machines for this work. In smaller pipe the use of a wheel-type cutter has been standard practice but, unfortunately, it cannot be used with any degree of satisfaction in sizes over 10 in. There are a number of methods which have come into use in the last few years for cutting the larger sizes of cast-iron pipe. The first of these methods utilizes a split machine which is clamped around the pipe. One or more tool bits of the parting-tool type travel around the pipe, cutting the metal with a straight even cut.

The second method utilizes a pipe-cutting machine which travels around the pipe on a track of chain. The power unit, which is either an air or an electric motor, is connected through a gear box to a rotary saw which travels around the pipe, removing the metal with a straight even cut.

The third method utilizes the electric arc-welding machine, which produces good cutting results by the use of a negative polarity rod in straight polarity. It is necessary to have a high output machine and a special technic is required of the welder handling the electrode. Under proper conditions this method can be very rapid and result in an even true cut.

The development and utilization of these three methods of cutting have resulted in speeding up the work of cleaning, and the even cuts made possible by them permit the use of the nipples taken out of the pipe, thus reducing costs for material on the job.

The installation of the pipe cleaning tool into the main has long been a laborious and time-consuming job. In recent years methods have been developed for inserting the cleaning tool so that comparatively it now takes only a few minutes.

The Author

Present day pipeline fittings serve as another means of speeding up cleaning. By the use of mechanical-type couplings, such as Dresser, Skinner or Simplex, coupling up of the pipe after the cleaning machine has been inserted now requires only a few minutes, as compared with the practice of yesteryear which sometimes consumed hours.

Another factor in speeding up the cleaning process has been the accumulation and compilation of data on the required flow and pressure to propel the cleaning machine at the most effective speed of travel through the line. It is now possible to predict with reasonable certainty what pressures and quantities of water are going to be required to propel the machine and the approximate speed at which it will travel. With this knowledge, the work can be scheduled and laid out so that many former uncertainties no longer exist.

One of the most recent developments in connection with water main cleaning is the use of the two-way radio for communicating from point to point and controlling the job. In the cleaning of large mains in distribution systems, we are faced with the problem of the disposal of large quantities of pipe cleaning water in heavily populated districts. The use of the two-way radio insures shut-offs before any damage can be done in the event of any failure of facilities to carry off the water.

### *Some Graphic Comparisons of Main Conditions*

Figures 1 and 2 constitute curves which illustrate the effect of the roughness of pipe interiors on carrying capacity. Some average coefficient for new pipe had to be assumed and in these curves the Hazen-Williams C value of 130 has been assumed for pipe 16 to 48 in. in diameter, and 120 for smaller diameters.

Figure 1 covers pipe in the sizes from 16 to 48 in. To read the uprating of a pipeline by cleaning, note that a 48-in. line with a coefficient as high as 115 has an effective diameter of 46 in. only. That 2 in. diameter loss represents a sizeable non-yielding investment in the 48 in. pipe that has but 46 in. service value. In this size pipe, cleaning would restore the main to 130 and the effective diameter to 48 in.

Figure 2 covers pipe from 4 to 14 in. diameter. A 14-in. pipe with coefficient of 80 would have an effective diameter of 12 in. only. In carrying capacity the loss is considerably greater, however, than the 14.3% loss in effective diameter. By cleaning, this effective diameter can be increased to 14 in.

As an example of successful restoration of an old line to satisfactory carrying capacity, a record of operation in Trenton, N. J., will be reviewed.

### *Main Rehabilitation in New Jersey*

Water for the city of Trenton is obtained from the Delaware River. An intake, built out into the river, supplies water to the suction side of low-lift pumps, whence it is pumped to the filter plant and there treated. The treated water flows by gravity to the suction side of high-lift pumps and is then carried through two ascending mains to the service reservoir which has a capacity of approximately 60 mil. gal. One of these ascending mains is a 48-in. lock-bar laid in 1907. The other ascending main is a 36-in. cast-iron bell-and-spigot laid in 1870. Figure 3 shows the plan of these two lines.

During the summer of 1940 it was decided to appraise these lines, determine their condition and lay out a suitable plan to insure their life. Since the lock-bar line was made of plate only 5/16 in. thick and, because access manholes were available, it was decided that this should be inspected first. Accordingly the line was shut off and dewatered. A manhole cover was removed and an access plate taken off so that it was possible to enter the main and inspect it. It was found that the line was in remarkably good condition considering its length of service. Very little tuberculation and no incrustation were present. The original coating had been an excellent job, but in numerous places it was completely gone and the bare steel was exposed. At the points where the steel was exposed, evidences of deterioration could be seen. After inspection the access plate was bolted up and the line restored to service.

*A paper read before the N. J. Section of the Am. Water Works Association, printed by permission of the Association.

Since the 36-in. ascending main had no access openings, inspection would have been extremely expensive. Therefore, tests were made on Aug. 29, 1940, to determine the coefficient of each line. The 48-in. lock-bar was found to have a coefficient of 108. The 36-in. cast-iron line was found to have a coefficient of 66. During the fall of 1940, plans were made for the rehabilitation of these two lines and in the spring of 1941 work was started which would eventually result in cement lining of both these lines *in situ* by a centrifugal process. It was decided to clean and cement-line the 48-in. line first and, after this was back in service, to clean and cement-line the 36-in. line.

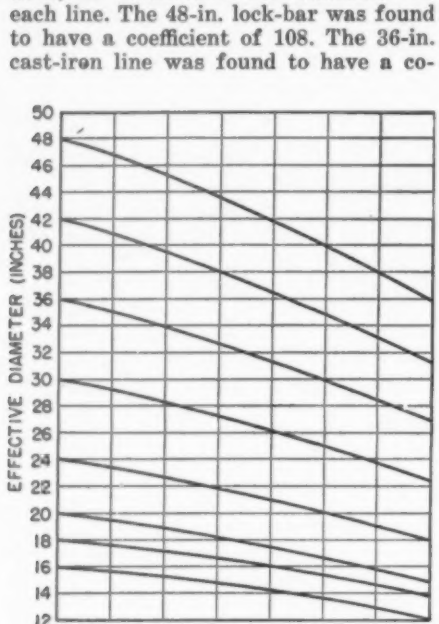



**Fig. 1—Curves Revealing Loss of Effective Pipe Diameter as Tuberculation Increases—Likewise Recovery of Line Capacity Through Main Cleaning.**

### *Cleaning and Lining a 48-in. Line*

In cleaning a steel line of this size there are a number of factors which must be considered and planning and scheduling must anticipate these problems.

Because of surges which may occur during cleaning, with resulting negative pressures, it is imperative that air vents capable of handling large quantities of air be installed. These air vents, or vacuum breakers, preclude the possibility of collapsing the pipe when, for any reason, a vacuum occurs in the line. Figure 4 shows the air vents which were designed and installed for this purpose.

As can be seen in the figure, the installation of such an air vent is rather simple. Using the plate of the air vent as a template, the welder cuts around all four sides of the plate after having set the plate so that its center line is on the vertical axis at the top of the pipe. The plate cut out is then removed and the hole in the pipe trimmed up. Then the frame for the vent is centered up over this hole and a heavy bead placed all around the frame on the outside. The gasket is then installed, the plate part of the vent lowered into the pipe and wedged up until ready for use.

The cleaning of the 48-in lock-bar entailed the installation of two such vents; one in the nipple where the machine was introduced and the other at a point where access was had to determine whether or not there were stays in the line.

The vents gave two orifices at high points in the line, rectangular in cross-sections, 18 × 24 in., through which air could enter the line and obviated all danger of collapsing the pipe.

Another danger in cleaning a line of this size is in allowing the machine to come out of the pipe, particularly on a down-hill shot. This danger obtains because of the piston effect of the machine. Should it be allowed to emerge completely, the sudden drop in water pressure in the line could conceivably cause the pipe to collapse. There is also the danger of spilling the tremendous quantities of water through the unobstructed pipe. To prevent this, it was necessary to build a very strong bulkhead in the hole where the machine was to make its exit, so that only part of the machine should leave the pipe and the piston-like skirt remain in the main, thereby causing the water to drain out of the line comparatively slowly. Plans for these bulkheads were made before the work started.

One of the problems to be considered in this job was the coupling up of lock-bar pipe. It was decided to use Dresser couplings for coupling up the nipples cut out for the entrance and exit of the cleaning and lining machines. Figure 5 shows the steps in the preparation of the pipe.

To prepare the pipe for the use of Dresser couplings it was necessary to cut off the outside of the lock-bar. The method used was to run two electric arc fillets along the inside joint of the lock-bars, both top and bottom, for a distance of 20 in. at both ends of the nipple. The lock-bar was then undercut on the outside, as shown in Fig. 5, and a fillet thrown on the outside which was finished off with a portable grinder, thus presenting a smooth surface on which the gaskets of the Dresser couplings could make a good seal. As can be seen from Fig. 5, the electric arc weld on the inside runs back for 20 in. and the cut of the lock-bar on the outside extends only 15 in. This overlap obviated any danger of a leak at this point. The lock-bars on the pipe projecting into the hole in the ground were treated in the same way except that the fillet on the inside was extended back only 12 in. and the cut on the outside 8 in. The Dresser couplings used had a width of 15 in. so that by placing the couplings on the nipple and dropping the nipple into place, then sliding the couplings over the pipe projecting into the hole, it was possible to center the Dresser sleeves over the cuts in the pipe.

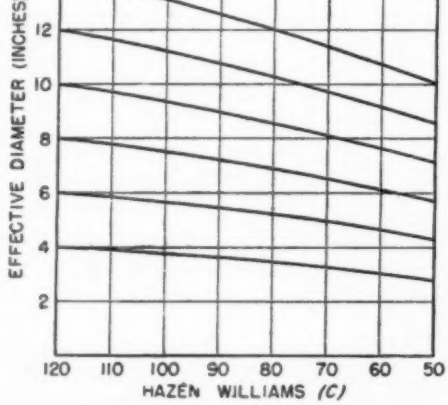



**Fig. 2—Curves Revealing Loss of Effective Pipe Diameter as Tuberculation Increases—Likewise Recovery of Line Capacity Through Main Cleaning.**

An important step in planning such work is the selection of entrance and exit points for the cleaning machine. The exit point is particularly important because here it will be necessary to dispose of large quantities of water. After a careful study the points were selected and the planning phase of the job was completed.

Work was started on June 2, 1941. Three excavations were made for the cleaning, which involved shooting a cleaning tool by water pressure from the reservoir back to the pump station. An excavation, as close to the reservoir as possible without undue interference with the fittings, valves, etc., was made on the 48-in. line. This excavation was 12 ft. long, 8 ft. wide and 10 ft. deep, which left 2 ft. of working room all around and under the pipe. In Fig. 3 this excavation is shown at (A) on the plan. So that the large quantity of water discharged during cleaning could best be handled and emptied into the Delaware River, the exit excavation was made 100 ft. back from the gate at the pump house. This excavation was made at (B) on the plan. It was 12 ft. long, 8 ft. wide and approximately 10 ft. deep. The 2 ft. of working room around the pipe, which had been the objective, was interfered with in two places. At one point an 8-in. service main running from the pump house to the filter plant projected into the hole; on the other side a 60-in. concrete sewer cut down on the working room. This hole was "tight-sheeted" using 3 × 10 tongue and groove sheeting. On the side of the excavation nearest the river, the sheeting was cut low and a flume fitted into the notch thus made. A flume, 50 in. wide, 25 in. high and approximately 250 ft. long, was constructed to convey the water overflowing through the notch in the sheeting into the Delaware River. Every effort was made to see that all preliminary work was completed before taking the line out of service so that the length of time the water was pumped through a single line—and the consequent higher pumping costs—would be held to a minimum.

After all preparation had been made, the 48-in. lock-bar main was taken out of service on June 11. The line was shut off and the air valves checked to make sure they were in working order. A blowoff at a low point was opened and the line dewatered slowly to avoid the danger of pulling a vacuum and collapsing this steep pipe. The dewatering process took from noon on June 11 until 8:00 A.M. on June 12.

Using the oxyacetylene torch, a nipple 6 ft. 6 in. long was cut out of the 48-in. pipe at (A). Actually three cuts were made as 1 in. was cut off the nipple so that it could be easily put back into the main by using Dresser couplings. The nipple was lifted out of the ditch so that one of the automatic air vents (Fig. 4) could be installed; the cleaning tool was then jacked into the nipple and the lockbar prepared for Dresser couplings, as illustrated in Fig. 5. The nipple, with the machine in it, was dropped into place in the line and coupled up with Dresser couplings.

A nipple was cut out at the exit hole and a bulkhead built to prevent the complete emergence of the cleaning machine and all was ready.

Through the co-operation of the Trenton police it was possible to secure the services of two two-way radio cars to facilitate the control operations. This was accomplished by leaving one radio car at the control valve so that the operator could immediately relay any instructions to the valve crew. The other radio car was used in following the machine so that it was possible at all times to increase or decrease the flow behind the machine.

### *Machine Speed Control Important*

When all was in readiness, the valve was slowly opened behind the machine until the pressure reached approximately 8 lb. The machine started off and proceeded at a slow rate through the pipe. The last 2,000 ft. of this line have a very sharp down-grade. As soon as the top of the grade was reached, the large quantity of water contained in the 5,000 ft. of pipe behind the machine was converted into head and, as the pressure increased, the speed of the machine increased so that its travel through the last 1,500 ft. was very rapid. During the shot it was found that with a pressure of approximately 8 lb. behind the machine, water at a 22-mgd. rate was consumed.

An inspection of the pipeline after this shot showed that, at the beginning of the line where the progress of the machine had been slow, the cleaning was a thorough job, but that the last 1,500 ft. of the shot had not given a very good cleaning job due to the rapidity with which the machine had traveled through this section of pipe. It was decided to shoot the machine again to see if it would be possible, by shutting off the water before the downgrade was reached, to control the speed of the machine so that a more thorough job of cleaning could be accomplished. This was attempted on June 20, 1941, but it was impossible to hold down the speed of the machine to a desirable point.

### *Two-Way Cleaning Proves Meritorious*

It was then decided to shoot the machine uphill, that is, from hole (B) (in Fig. 3) toward hole (A), using the pumps at the pump station as a source of pressure. This necessitated the "tight-sheeting" of the hole at (A) and the building of a rugged bulkhead at this point so that the machine would not come all the way out of the pipe with a resulting surge of water.

The fact that the point where the wash water was to be disposed of was in a rather heavily populated district presented another problem in shooting uphill. It was necessary, therefore, to make a survey of the sewer system in the area to determine how to dispose of the large quantity of water which would be discharged during the shot. The problem was solved by sand-bagging along the curbs of the streets and distributing the load over a number of large storm sewers. When all of the preparatory work was completed the machine was shot uphill and, in this process, it was possible to control its speed very accurately, using the radio cars as a means of communication with the pump house.

After this uphill shot the line was found to be properly cleaned and was ready for the cement lining.

### *Lining Operations*

The 48-in. cement-lining machine is powered by an electric motor and travels through the pipe, applying the mortar centrifugally as it travels. It is followed by adjustable rotary trowels. Current for the motor is supplied through a cable which is run inside the pipe back to a mobile alternator. As the lining machine travels back through the pipe, the cable is pulled toward the alternator and wound up on a reel.

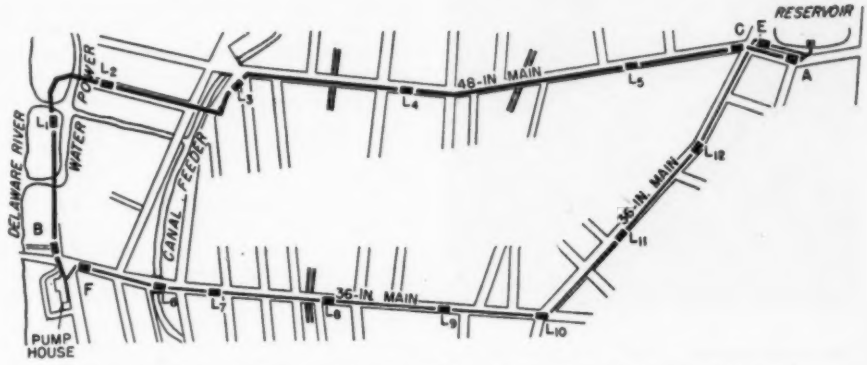



**Fig. 3—Plan of Trenton, N. J., Mains Cleaned and Cement Lined.**
*(Stations of entry and egress of cleaning machine and lining apparatus are indicated.)*

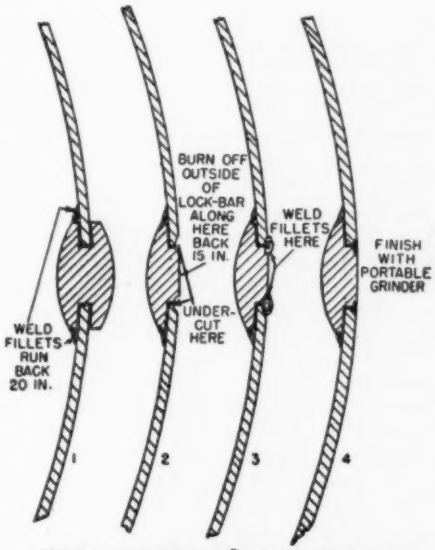



**Fig. 5—Steps in the Preparation of Lock-Bar Pipe for Dresser Couplings.**

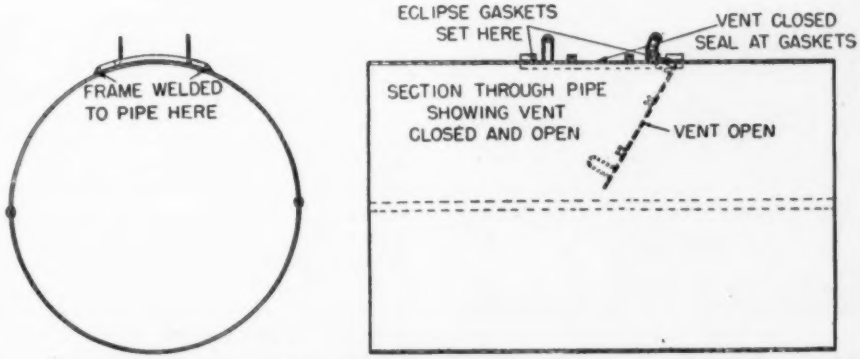

FRAME WELDED TO PIPE HERE
ECLIPSE GASKETS SET HERE
VENT CLOSED SEAL AT GASKETS
SECTION THROUGH PIPE SHOWING VENT CLOSED AND OPEN
VENT OPEN

**Fig. 4—Automatic Air Vents Installed on Trenton Steel Mains.**

Fig. 6—Centriline Pipe Lining Machine in 36-in. Main.

The cement mortar is mixed in a mobile wet batching machine. The mortar is dropped through the chute at the hopper and into rubber-tired buggies placed below it inside the pipe. The buggy, full of mortar, is pushed to the lining machine, the mortar transferred to the hopper of the lining machine and the buggy returned for another load of mortar.

Figure 3 shows how the lining machine was inserted in the pipe at the hole near the filter plant and run back toward the pump station. The batching machine and the alternator were located at this hole and the pipe was lined from the gate at the pump house back to the hole. The batcher and the alternator were moved to the first access hole, the nipple dropped into place, coupled up and the machine placed the lining right through the nipple.

Because of the mortar transportation problem it was necessary to have small holes about every 1,000 ft. so that the wet-mix concrete could be dumped through a chute into buggies on the inside of the main at these points, and transported for shorter distances to the lining machine itself. It will be seen on the plan that there were a number of small excavations where this was done. After the lining was completed, the manholes were bolted back and the lining was made one continuous cylinder right past these access manholes.

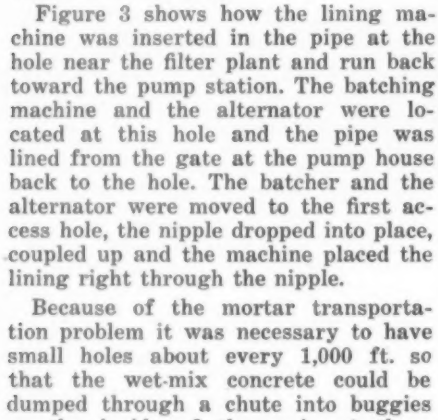


Fig. 7—36-in. Line of Trenton Before Cleaning.

When the exit hole at the far end was reached, the machine was turned around and sent up into the pipe at the far end. The pipe was lined back to the hole, the lining machine lifted out of the hole, the nipple lined up on the ground, lowered into place and coupled up. Thus a continuous lining was provided from one end of the line to the other.

The line was sterilized and put back in service on July 31. The sterilization was accomplished by feeding water containing chlorine to the extent of 60 ppm. and running it right through into the reservoir. Although this water as it entered the reservoir had a very high residual, there never was detected any increase in residual in the distribution system.

With the 48-in. line back in service—it had been out of service only 38 working days—it was now possible to go ahead with the cleaning and cement lining of the 36-in. line.

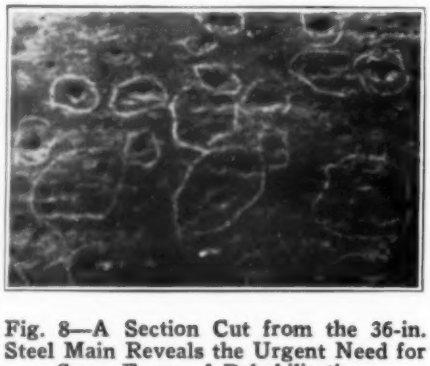


Fig. 8—A Section Cut from the 36-in. Steel Main Reveals the Urgent Need for Some Form of Rehabilitation.

### *Cleaning and Lining a 36-in. Line*

The 36-in. line was laid in 1870 and there was no record of some of the older connections to it. This line was shut off on Aug. 1, 1941, and, with the 36-in. line off, a test was run on the 48-in. line for leakage. We were unable to measure any leakage in this line after cleaning and cement lining, although the test was run over a 24-hour period.

On August 2 the 36-in. line was dewatered by running the water out through a 16-in. side connection. An attempt was made to cut the cast-iron pipe by means of the electric arc at the point (E) which was to be the entrance hole for the cleaning machine. The attempt was not successful because it was impossible to obtain an electric arc welder having a capacity larger than 200 amp. and, for the successful cutting of this thickness of cast-iron, a machine of at least 600-amp. capacity is required. This nipple was finally cut out using an oxyacetylene cutting torch of special design and the results obtained with this method of cutting were very good, as were the results of the cutting at the exit hole (F).

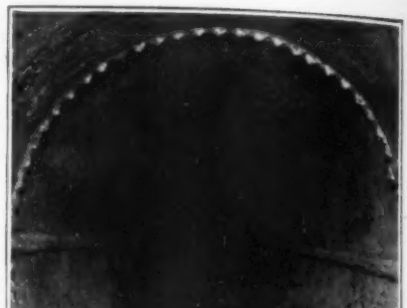


Fig. 9—Barrel of 48-in. Lock-Bar Main After Cleaning.

The 36-in. cleaning machine was placed in the nipple which had been cut at (E) in Fig. 3 and, on the night of August 5, when everything was in readiness, the shot was made.

In the course of this shot the machine negotiated two short-radius 90-deg. bends. Examination of the pipe showed that a very good job of cleaning had been done but that an additional shot would be necessary to attain the smooth condition needed for a good cement lining job.

A second shot was made during the night of August 6 and examination of the pipe after this shot showed that an excellent job of cleaning had been done and that the pipe was ready for cement lining.

Figure 6 shows the 36-in. lining machine operating within the main.

Access for cement lining was had at a number of points indicated on the plan (Fig. 3), and manholes were fabricated by drilling a series of holes making a circular piece which could be

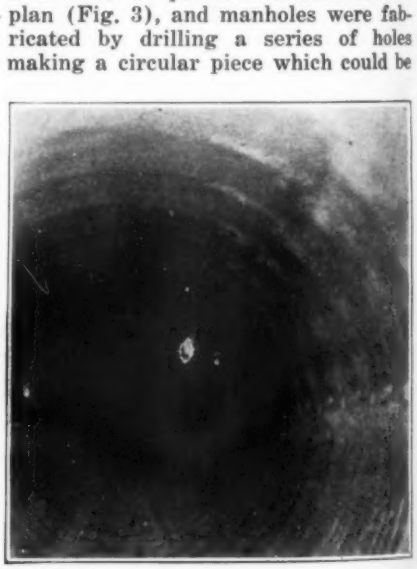


Fig. 10—The Completed Job on the 48-in. Main—and Good Now for at Least 50 Years More, with Sustained Delivery Capacity.

broken out of the top of the pipe. A saddle was then fastened to the pipe and a cast-iron plate fastened in this saddle. No particular difficulties were experienced during the lining of the 36-in. pipe and the work was completed on Aug. 21, 1941. The line was sterilized, using the same quantities of chlorine and procedure employed on the 48-in. line.

### *Results*

A test for capacity and coefficient was made on these two lines more than two years later. The 48-in. line was found to have a coefficient of 144 and the 36-in. line a value of 135, as compared with 108 and 66, respectively, before rehabilitation. These coefficients are corrected for the reduction in area due to the thickness of the cement lining.

The reduced friction loss results in considerable power saving amounting to from 15 to 17 per cent.

Figure 7 shows the 36-in. line before cleaning. Note the flow-impeding tuberculation.

Figure 8 shows the condition of a portion of the steel main discovered during the lining process. It can readily be seen that the corroded and pitted condition was serious and would soon have led to trouble.

Figure 9 shows a section of the 48 in. main after two-way cleaning and ready for cement lining.

Figure 10 is a view of the same line after lining. The lining is extremely smooth. The illusion of rings or large circumferential corrugations is a light reflection phenomena.

Another result of the cement lining is that the old lines have been made bottle tight. In the five-year period preceding the cement lining of these two mains, leakages bad enough to need repair were found on the average of eight times per year. Since the completion of this work in 1941 not one leak has been discovered on the 48-in. line. In addition, a test run on the 48-in. and 36-in. lines together showed a leakage so small that it is practically impossible to measure it.

The job has been of great benefit since costly repairs, which would have been necessary, have been obviated. The two lines are bottle tight, and the friction loss has been reduced so that pumping costs are held to the value for new pipe.

Another advantage, which is difficult to evaluate, is that the life of the failing lock-bar line has been increased at least 50 years. This, in itself, is worth many times the cost of the cleaning and cement lining.

### *Acknowledgments*

The author wishes to express his appreciation to Alvin Bugbee, Supt. and Chief Engr. of the Trenton Water Dept., and his staff for their cheerful co-operation in supplying data for this paper. The author is also indebted to H. Seaver Jones, Pres. of Centriline Corp., and members of his organization for their help in preparing this article.

## Hurricane Headaches!

**N. Y. Section, AWWA, Hears Story**

While the song writer paints a glowing picture of "the wind and the rain in her hair," the 1944 hurricane on the east coast made the water works men revise this line to read "the wind and the rain gets in our hair." This was the theme of three talks given at the mid-winter luncheon conference of the New York Section of AWWA held in the Hotel Pennsylvania on January 17. This is the annual meeting at which the New York Section is host to the visiting directors and section secretaries of the AWWA.

This particular meeting also featured an address by Arthur H. Motley, publisher of the American Magazine, who said that we could expect peace as long as we stayed on top, and that we could stay on top only as long as we made jobs, and that we could only make jobs as long as we plan boldly and aggressively, and pre-test these plans and accept the responsibility for carrying them out.

"The Present Outlook" was reviewed by Arthur E. Gorman, Director of the Water Division of OWU, Washington, who said the present situation and the effect of a change in the war picture has placed us back where we were in 1942, with lead, copper, lumber, and steel sheets still tight; a condition which does not warrant, however, cutting back on currently needed maintenance.

F. Rigdon Berry, Engineer, American Water Works & Electric Co., New York, explained the six divisions of maintenance work in his "Classification and Control of Maintenance." These divisions include: Emergency, for restoration of service; Essential, for continuation of service; Required, by public authority; Necessary, which may be scheduled; Deferrable, which includes decorating; and Marginal, which is doubtful.

But to return to the hurricane which struck Long Island, New York City and Westchester County, as well as Connecticut and elsewhere along the eastern coast last Fall. J. L. Barron, Director of the Division of Sanitation, Nassau County Dept. of Health, reported that in Nassau County the lights went out about 8 p.m. and 25 municipalities suffered power stoppage, 18 of which had auxiliary supply. Water interconnections proved their worth in 95 instances; chlorination also proved its worth. One interesting and unusual pollution problem of a water supply occurred in an elevated tank. Roof drainage into the gutter around the tank was discharged into the tank. With the heavy downpour of rain, concurrent with the hurricane, the bird manure deposits of countless pigeons had been washed into the tank, thereby polluting the supply in a manner which took several days to discover.

A. C. Hutson, Asst. Chief Engineer of the National Board of Fire Underwriters, New York, said that, although only two hurricanes had occurred in the last 150 years, they had both occurred within six years' time, and that no longer could one ignore the probability. His best advice was to be sure that the reserve equipment works.

Reeves Newsom, Village Manager of Scarsdale, New York, said that among the lessons to be learned from the catastrophe of last Fall was to provide more reliable power and power auxiliaries, to provide more elevated storage; where possible, to eliminate large trees that might fall on small lines, and to provide more interconnections (a good post-war plan); and, above all, not to trust one's luck too far.

## Alden Becomes Sewerage Engineer for Wilmington, Del.

John W. Alden, formerly County Engineer of New Castle County, Del., is now associated with the Street and Sewer Dept. of the City of Wilmington, Del., as assistant to Harry L. Meier, Chief Engineer. Mr. Alden will be in charge of sewer work and will devote most of his time for the present to post-war work on interceptor sewers and sewage treatment.

**John W. Alden***

Mr. Alden joined the County Engineering Dept. in 1931 and in 1937 was made County Engineer, which position he has held until January 1, 1945. Under his supervision sanitary sewerage systems were constructed in about thirty-five suburban communities in New Castle County, involving about eighty miles of sewers and three sewage treatment plants.

[*Last spring, Mr. Alden was elected President of the Maryland-Delaware Water and Sewerage Association, in which he has taken an active interest for the past several years.—Ed.]

# SOLUTION OF MANNING'S FORMULA FOR FLOW IN OPEN CHANNELS

By DONALD R. KEITH
Civil Engineer
DIVISION OF WATER
COLUMBUS, OHIO

BEFORE entering into an explanation of the use and operation of Manning's Formula, a brief introduction should be made as to why it was used for the basis of this chart.

Kutter's Formula is generally preferred for its accuracy and a great number of engineers have become accustomed to estimating the condition of a stream in terms of Kutter's "n". Unfortunately, Kutter's Formula does not lend itself easily to this type of chart without complicating the whole process. Manning's Formula was therefore carefully studied in comparison. Kutter and Manning Formulas use the same value for "n" and, when $r = 1$ meter, they are identical expressions and give identical results.

Several typical problems were solved by each formula and the results compared. These all checked to the first and second decimal places and, in a few instances, to the third decimal place. In no instance did the third place differ more than one point at most.

Furthermore, Manning's Formula, $V = \frac{1.486}{n} r^{2/3} s^{1/2}$, adapts itself very nicely to nomographic chart calculation.

### *How to Use the Chart*

An explanation of the use and operation of the accompanying chart follows:

A glance at the chart will show that all scales, with the exception of the n-scale, read up. The n-scale reads down. The product of $r^{2/3} \times s^{1/2} \times$ the constant 1.486 is divided by "n"; therefore, the n-scale must be inverted.

The s-scale represents the slope or hydraulic gradient in decimals of a foot per lineal foot.

The r-scale represents the hydraulic radius, which is equal to A/p, in which A = the area of the cross-section and p = the length of the wetted perimeter of the cross-section, in feet.

The v-scale represents the velocity of flow in feet per second.

The Q-scale represents the discharge in cubic feet per second on its right side, and gallons per minute on its left side. The Q-scale is calculated from $Q = Av$.

The A-scale represents cross-sectional areas from 10 sq. ft. to 10,000 sq. ft.

### *Example (1)*

In the solution of the first problem, as shown by one group of index lines on the chart, we have given:

$s = 0.00015$ ft. per lineal foot
$r = 2.19$, and $n = 0.035$
Required, the velocity "v"

First, align the straight-edge from $s = 0.00015$ to $r = 2.19$; from the intersection of this line with the axis, align the straight-edge to $n = 0.035$; where the straight-edge cuts the v-scale, read $v = 0.877$, the answer.

In this problem, suppose the cross-sectional area $A = 100$ sq. ft. and the discharge Q is desired. Set the straight-edge at the point just found above, namely, $v = 0.877$, and align it to $A = 100$; where the straight-edge cuts the Q-scale, read $Q = 87.7$ cfs. or $Q = 39{,}359.76$ gpm. (gallons per minute). This scale cannot be read that close, but it does show between 39,000 and 40,000 gallons per minute.

### *Example (2)*

In the solution of the second problem shown by another group of index lines on the chart, $s = 0.0001$, $r = 1.0$, and $n = 0.01$ (incidentally, this problem was used to spot the starting points when laying out the scales).

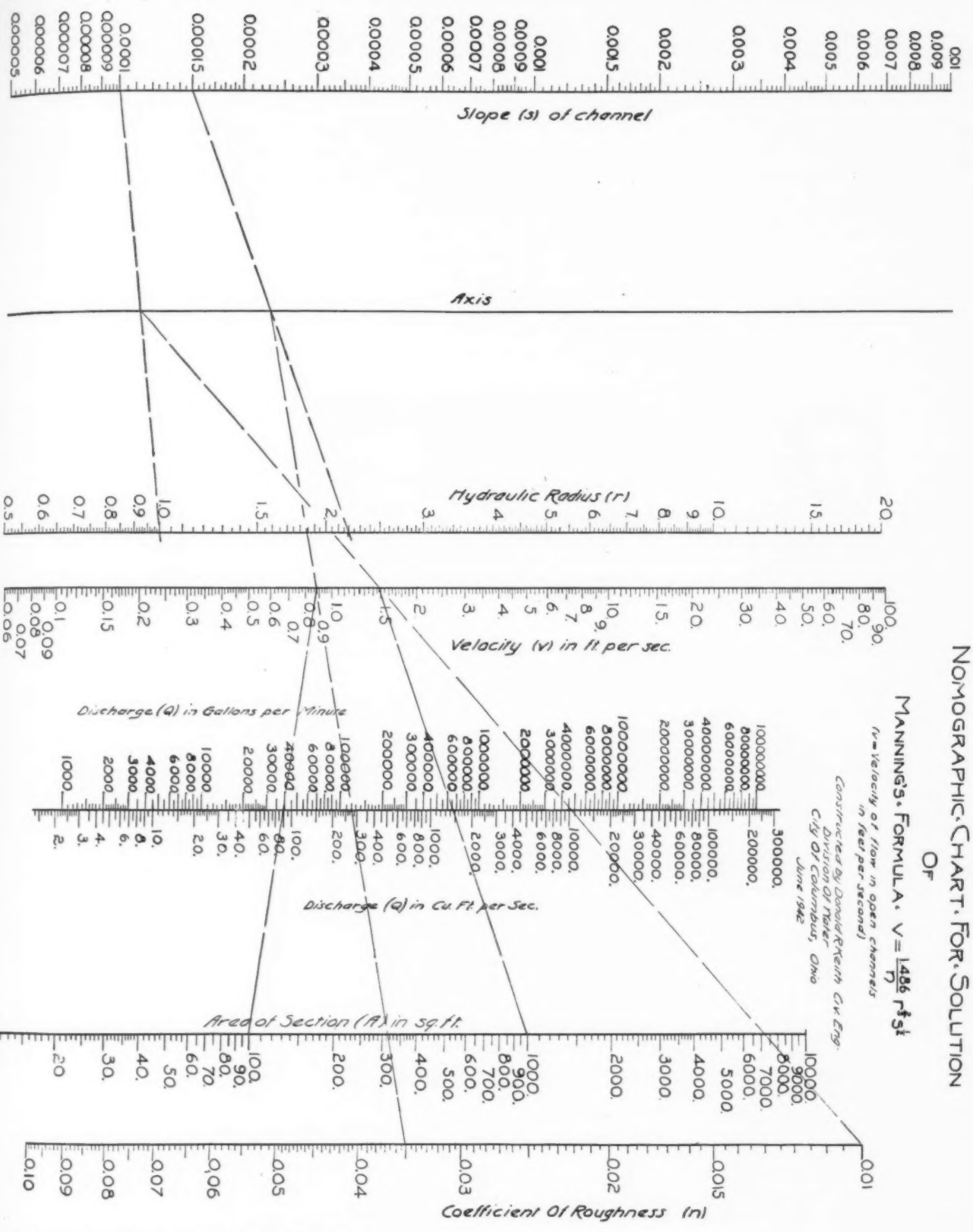
First, align the straight-edge from $s = 0.0001$ to $r = 1.0$; from the point where the straight-edge cuts the axis, align to $n = 0.01$; where the straight-edge cuts the v-scale, read $v = 1.486$ ft. per sec.

Suppose in this case the cross-sectional area $A = 1{,}000$ sq. ft. and it is desired to know the discharge Q. Set the straight-edge to 1.486 on the v-scale (the velocity just found), then align to $A = 1{,}000$; where it cuts the Q-scale, read $Q = 1{,}486.0$ cfs. or $Q = 667{,}000$ gpm.

The index lines plotted on the chart merely trace the operations in solving the problems just explained. They are not there for any other purpose.

### *Values for "n"*

Values for "n" vary from 0.01 for neat cement, 0.013 for clean brick, 0.015 for unclean brick or cement, 0.02 for new canals, 0.025 for average canals, 0.035 for moderately rough earth and rock channels, 0.05 for channels in very poor condition, and 0.07, or even 0.08, for channels with bank-slopes and bottoms obstructed with small trees and undergrowth.


Slope (s) of channel
Axis
Hydraulic Radius (r)
Velocity (v) in ft per sec.
Discharge (Q) in Gallons per Minute
Discharge (Q) in Cu. Ft. per Sec.
Area of Section (A) in sq. ft.
Coefficient Of Roughness (n)
NOMOGRAPHIC CHART FOR SOLUTION OF MANNING'S FORMULA: $V = \frac{1.486}{n} r^{\frac{2}{3}} s^{\frac{1}{2}}$
(v = Velocity of flow in open channels in feet per second)
Constructed by Donald R. Keith, C.E. Engr.
Division of Water
City of Columbus, Ohio
June 1942

Index show that when S = 0.0001, r = 1.0, and n = 0.01, v = 1.486; A = 1000, and Q = 1486.0
Also, when S = 0.00015, r = 2.19, and n = 0.035 v = 0.877; A = 100, and Q = 87.7

# FIRST INDUSTRIAL WASTE UTILIZATION CONFERENCE HELD AT PURDUE

## 203 Register to Hear Experts Discuss Problems at First Conference of Its Kind

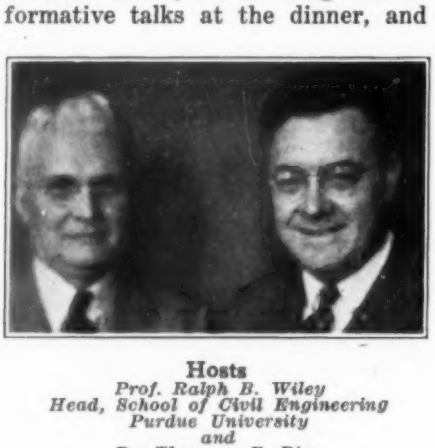
UNDER the general chairmanship of Prof. Don E. Bloodgood, aided and abetted by the energetic Joe L. Quinn, of the Indiana State Board of Health, Purdue University inaugurated a unique and useful annual meeting when it held the first industrial waste utilization conference on Nov. 29-30 of the past year.

With a registration of 203, the cooperation of the School of Civil Engineering, three state boards and a dozen other commercial and industrial associations, the efforts of Prof. Wiley, Head of the School of Civil Engineering, and Prof. Bloodgood, Assoc. Prof. of San. Engineering, were crowned with success. Not only were there many water and sewage operators, chemists and superintendents present, but there were also a large number of representatives of industries and industrial associations. Mr. Quinn's organization had aided materially in advertising the meeting throughout the industries of the state.

Undoubtedly one of the big attractions was the program which the chairman had scheduled. The directory of men taking part in program read like a veritable "Who's Who" in the field of sewage and industrial waste treatment. The men responsible for the success of this first conference have indeed set a high mark for future program builders to shoot at. If future programs *are* as good, we predict a growing attendance each year hereafter, with the out-of-state registration being a larger and larger part of the attendance, in spite of the fact that the conference is designed primarily to aid industry in the State of Indiana.

One could (and if paper shortage did not prevent, probably would) write at greater length about the hospitality of the Purdue Memorial Building, the inexpensiveness of the excellent meals, the amusing and informative talks at the dinner, and the general atmosphere of cooperation and information.

**Conf. Chairman**
*Don E. Bloodgood*
*Assoc. Professor*
*Sanitary Engr'g*
*Purdue Univ.*
*Lafayette, Ind.*



**Hosts**
*Prof. Ralph B. Wiley*
*Head, School of Civil Engineering*
*Purdue University*
*and*
*Dr. Thurman B. Rice*
*Actg. Comm. of Public Health*
*Indiana State Board of Health*

**Indiana Mainspring**
*Joe L. Quinn*
*Acting Director*
*Bur. of Sanitation*
*State Bd. Health*
*Indianapolis, Ind.*

*(Cooperation was the motive—information was the theme)*

### *Symposia*

There was one feature of the meeting which deserves more than passing mention. That feature was the symposia held on one afternoon. Meeting in separate rooms, under the presiding offices of persons well acquainted with the particular problems and wastes, eight different symposia were carried on. Because of the concurrence of these meetings, it was impossible for this reporter to cover more than a few minutes of each. But those few minutes were enough to assure any one that information was being disseminated to those who wanted to know by those who did know.

The variety of problems and solutions to industrial waste problems discussed at these individual symposia sessions (attended by from ten to twenty-five persons) is evidenced by the following short summary of notes taken during a tour of the meeting rooms.

*Milk Wastes:* Presiding, Dr. H. A. Trebler, Chem. Engr., Sealtest Research Laboratories, Baltimore, Md. —Savings to industry, uses of milk whey, and cooperation of the industry with the State Dep't of Health are possible.

*Distillery, Starch, and Brewery Wastes:* Presiding, H. W. Streeter, Sen. San. Engr., USPHS, Cincinnati, O.—Recovery of distiller's dried solubles in one plant pays for the operation of the research laboratories which worked out the process, among others.

*Food Canning Wastes:* Presiding, L. F. Warrick, State Sanitary Engineer, Madison, Wis.—If broad irrigation is used, fields must be rotated. Lagoons are useful where the soil is tight. Sodium nitrate is helpful in lagoon treatment. In any treatment, food canning wastes should be screened at the plant. Where lagooning is used, thorough investigation should establish the fact that no crevices exist to allow direct travel of the waste into underground water supplies.

*Refinery, Steel Mill and Mine Wastes:* Presiding, Dr. F. W. Mohlman, Dir. of Laboratories, Sanitary Dist. of Chicago.—Mine sealing programs have proved to be of great benefit. Pickle liquor still remains a big and unsolved problem. Of half a billion tons of ferrous sulfate produced by pickling each year, only five per cent is recovered, and of this probably not more than half is used for coagulation of water and sewage.

*Paper Manufacturing Wastes:* Presiding, Dr. H. W. Gehm, Technical Advisor, National Council for the Improvement of Streams, New York City.—Kraft paper waste may be advantageously recovered to burn as fuel. By-product recovery is feasible. Conversion of small plants from old methods to modern systems with recovery is possible, but may not be economically feasible. The National Council has been organized by the pulp and paper industry to aid in the solution of many of the problems in which this industry is involved.

*Packinghouse Wastes:* Presiding, R. E. Bragsted, City Engr., Sioux Falls, S. Dak.—There is no best type of treatment for packinghouse wastes. Individual plants and problems require and respond to different types of treatment. Grease recovery is advisable in all cases, and settling must be a part of any treatment process. Chlorination, or treatment on trickling filters, by activated sludge or otherwise, depends on the problem involved.

*Water Treatment Problems:* Presiding, W. E. Howland, Prof. of Civil Engineering, Purdue Univ.—The latest method of treating tastes and odors caused by phenolic wastes is the new Chlorine Dioxide treatment.

*Sewage Disposal:* Presiding, David P. Backmeyer, Supt. of Sewage Treatment, Marion, Ind.—Problems in sewage treatment plants may and usually do arise from any number of industrial wastes discharged into the sewerage system. Not the least of these in one Indiana city is chicken feathers.

### *Improved Equipment Saves Milk Wastes*

Pointing out that **"Waste Saving by Improved Milk Plant Equipment"** is the modern way of milk waste treatment, Dr. H. A. Trebler, Chemical Engineer, Research Laboratories, Sealtest, Inc., said that it is more economical to decrease the waste to be disposed of by improving plant efficiency than it is to install a waste treatment process.

One item needed in the milk industry is an improved type of milk can which will not only reduce the loss of milk but will also increase cleanliness.

The extent of milk loss may be realized from the data on one plant where it was found that the loss was worth $130 a day. Some of this loss can be prevented by eliminating boil over in evaporators. Another source of waste is in roll driers. Spray driers are better and less wasteful.

Dr. Trebler said, "It is better to spend money on equipment to improve the product and reduce the waste than to spend it on sewage treatment, which is non-productive."

### *Meat Packing Wastes Treated in City Sewage Plants*

Speaking on **"Cooperative Efforts of Cities and the Meat Packing Industry in Treating Industrial Wastes,"** R. E. Bragsted, City Engr., Sioux Falls, S. Dak., told of the experiences of that city over the past thirty-three years.

In this city of 45,000 population, the packinghouse wastes had grown to be such a problem by 1927 that some solution had to be sought. It was decided that separate sludge digestion would be used, and that the industries would pay the costs of pumping the waste. At that time the packinghouse waste had a B.O.D. of 1,200 and suspended solids content of 1,000 ppm. in a flow of 1.9 mgd. compared to the domestic flow of 2.0 mgd. of sewage with a B.O.D. of 300 ppm. and a suspended solids content of 300 ppm. All wastes were to be screened at the packing plant.

**Session Presiders**

*Louis F. Warrick*
*Chief San. Engr.*
*State Bd. Health*
*Madison, Wis.*

*Dr. Geo. E. Symons*
*Assoc. Editor*
*"Water Works and Sewerage"*
*New York City*

*Cecil K. Calvert*
*Supt., Purification*
*Idpls. Water Co.*
*Indianapolis, Ind.*

This arrangement subsidized the industry to some extent, but the industry recognized its obligation. This treatment was not enough and, by 1935, it was decided that chemical treatment of the industrial wastes and activated sludge treatment of the trickling filter effluent would be necessary. The packers were to pay for a part of the cost of construction, part of the costs of operation ($10,000 a year), part of mechanical repair costs, and a part of any future construction needed.

By 1944 the industrial waste flow was 3.7 mgd. with a B.O.D. of 2,470 ppm. and suspended solids of 1,870 ppm., compared to the city flow of 2.6 mgd. with a B.O.D. of 395 ppm. and suspended solids of 368 ppm. The city was operating the pre-treatment process, with the packers paying a part of the yearly operating costs as before.

Meanwhile damage suits from riparian owners downstream had been instituted and paid in some cases. It was in connection with one of these suits that the court ruled that, inasmuch as the permit of anyone to enter a sewer was a right that could be revoked, then the city and the industry could not enter into a contract as they had done. This decision nullified the existing contract, but the Morell Co. and the city agreed to abide by the terms of the contract anyway, thus indicating the excellent cooperation between the city and the industry. Mr. Bragsted said that a simpler method of handling the whole problem would have been a rate schedule under a sewer rental as is done at Buffalo, N. Y. (For the Buffalo formula, see March, 1944, issue of "Water Works and Sewerage.")

### *Legal Background of Stream Pollution in Indiana*

Stream pollution control in Indiana has had several ups and downs since the first attempt was made to prevent pollution late in the last century. Using the same legal principles involved in the right of one water taker to use the water and the right of a downstream taker to receive the water in its natural condition, the courts of Indiana had ruled in diverse ways on several occasions.

Laws to control pollution were passed in 1904, '09, '13, '27, '35, and 1943. The 1935 act was good but was repealed in 1941 because it was a rider to another bill and so was repealed when that bill was repealed, thus demonstrating the ridiculous procedure of riders to bills.

In 1943 a new law was passed setting up a Stream Pollution Control Board, a bi-partisan board of six men, who meet six times a year and have a technical secretary who is a qualified sanitary engineer. This board must approve all plans for sewage or waste treatment in Indiana; it may order a hearing on a waste problem, leading to an order that the pollution be stopped.

### *Utilization and Disposal of Industrial Wastes*

The choice of the program chairman, of Dr. F. W. Mohlman, Dir. of Laboratories, San. Dist. of Chicago, to talk on the general subject of utilization and disposal of wastes was a happy one, for Dr. Mohlman's experience with a wide variety of wastes in Chicago is perhaps unequaled elsewhere.

**They Know About Industrial Wastes**

**Paper**
*Gladys Swope*
*Indust. Fellow*
*Mellon Institute*
*Pittsburgh*
*and*
*Dr. Harry Gehm*
*Tech. Advisor*
*National Council for*
*Stream Improvement*
*New York City*

**Alcohol**
*Dr. R. A. Rasmussen*
*Nutritionist*
*Hiram Walker & Sons*
*Peoria, Ill.*
*and*
*Harold C. Feightner*
*Exec. Secy.*
*Ind. Brewers Assn.*
*Indianapolis, Ind.*

**All Types**
*Dr. Willem Rudolfs*
*Chief, Dept. Water &*
*Sewage Research*
*N. J. Agr. Expt. Sta.*
*New Brunswick, N. J.*
*and*
*Dr. F. W. Mohlman*
*Dir. of Laboratories*
*Chicago San. Dist.*
*Chicago, Ill.*

**Food**
*N. H. Sanborn*
*Res. Chemist*
*Nat. Canners Assn.*
*Washington, D. C.*
*and*
*D. T. Sherow*
*Chemist*
*Stokely Foods*
*Indianapolis, Ind.*

**Metal and Oil**
*William S. Wise*
*Chief Engr.*
*State Water Com.*
*Hartford, Conn.*
*and*
*R. F. Weston*
*Sanitary Engr.*
*Atlantic Refining Co.*
*Philadelphia, Pa.*

As a typical example of how a large industry can attack its problem, Dr. Mohlman cited the corn products refinery where the wastes were bottled up and, by recirculation and settling, practically eliminated. This bottling up procedure has been successfully employed in the paper industry and in some chemical industries.

In Chicago, some three hundred plants have been surveyed; with samples being taken at 15-minute

**Programmers**

*Dr. M. M. Ellis*
*Sr. Aquatic Physiologist, U. S. Fish & Wild Life Service*
*Columbia, Mo.*

*H. A. Trebler*
*Chemical Engr.*
*Sealtest Research Labs.*
*Baltimore, Md.*

intervals and analyses made for suspended solids, B.O.D., and ammonia and organic nitrogen.

From these studies it has been observed that industrial wastes have high carbon to nitrogen ratios, except in food, meat, and tanning industries. Data from the studies, when projected to all industries in the city, indicate a population equivalent load of nearly two million persons.

At the present time grease is being recovered for sale, and oils from rolling mills and aeroplane factories are recovered for reuse or other disposal rather than being discharged into the sewer. As regards grease from packing plants, Dr. Mohlman said that the grease loss to the sewer should and could be kept at not more than 0.1 lb. of grease per 1,000 lb. of live weight kill.

### *Metallurgical Wastes*

Mr. W. S. Wise, Chief Engineer of the Connecticut State Water Commission, brought to the Indiana group the experience of the state of Connecticut in the **"Treatment of Wastes Produced in Metallurgical and Metal Working Industries."**

Pointing out that any program of waste pollution abatement must be based on regional boundaries and must be predicated on the basis of "use but not abuse" of streams, Mr. Wise gave some interesting figures on the amounts of brass and copper wastes in Connecticut. It is estimated that 2,500 tons of copper are lost to the streams each year, along with much pickling acid, both of which find their greatest loss in the dilute pickling liquor wash waters.

Methods for the recovery of copper and chromium wastes are known and are successful, although they may not always quite pay for themselves. On the other hand, recovery does pay in other ways so that there is little, if any, net loss in the process.

Iron and steel pickling liquor wastes are still a great problem and, while the spent pickle liquor acid is not of so great importance, the loss of iron is. New methods of removing scale and of recovery of ferrous sulfate have been studied in the last few years. These include the following among others:

Inhibitors to decrease the attack of the acid on the metal while not decreasing the attack on the scale.

An organic chemical, chlorinated benzene, to lie on the bottom of the pickle vat and cover the settling iron particles, thereby preventing further acid action on them.

A preferential solvent to remove the ferrous sulfate.

An electrolytic process.

Refrigerate to reduce solubility of ferrous sulfate.

Evaporation and crystallization of the salt.

Production of Ferron, a mixed calcium and ferrous sulfate, used in insulating board or in purifying illuminating gases.

Mr. Wise also spoke about cutting oils and cooling oils.

### *Sewage Treatment and Industrial Wastes*

Prof. Don E. Bloodgood, General Chairman of the Conference and Assoc. Prof. of Sanitary Engineering at Purdue, spoke principally for the benefit of those persons from

**Programmers**

*W. W. Hodge*
*Dean of Engr'g*
*Uv. of W. Virginia*
*Morgantown*

*Col. H. W. Streeter*
*San. Eng. Dir.*
*U.S.P.H.S.*
*Cincinnati, O.*

industry who were not familiar with the problems that industrial wastes create in sewage treatment plants. Prof. Bloodgood explained population equivalent as a measure of strength of waste, and said that certain types of waste caused difficulty in different parts of a sewage treatment plant. For example, paunch manure settles in grit chambers, as do tomato seeds; fats and greases cause scum in primary tanks; while wool fibres, metal plating wastes, etc., cause difficulties in secondary treatment processes, and paper waste, oils, and sand cause troubles in digestion tanks.

Prof. Bloodgood offered the following suggestions to industry as a means to assist sewage treatment plant operations.

1. Maintain uniform waste flow and composition.

2. Keep suspended solids as low as possible.
3. Keep pH approximately normal.
4. Do not discharge any toxic substances.
5. Keep concentration of carbohydrates low.

### *Utilizing By-Products from Brewery Wastes*

Although recovery of by-products from brewery wastes may not be economically feasible, still it may be cheaper to recover some products if the waste must be treated to eliminate its pollution load. Among the several by-products that have been studied in brewery wastes are fertilizer (not productive), riboflavin, glycerol, potash, organic phosphates, and the production of methane and carbon dioxide by fermentation. All this was brought out by Dr. William Rudolfs, Chief, Dept. of Water and Sewage Research, N. J. Agr. Expt. Sta., New Brunswick, N. J., in his talk on **"Utilization of By-Products from Brewery Wastes."**

Dr. Rudolfs believes that the future treatment of brewery wastes will be confined principally to the weak wash waters, while the liquors with high oxygen demand will be concentrated and utilized in some manner to recover by-products.

Among the methods of treatment of wastes it appears that settling is of limited value, land treatment a nuisance, and electrodialysis not practical. Chemical process of coagulation and agglomeration and of precipitation of soluble substances is possible, but produces large volumes of sludge to be disposed of and is, therefore, not economical. Biological treatment with pure cultures has been done in Scandinavia and anaerobic digestion has been practiced in this country. Three-stage digestion for 3½ days reduces the B.O.D. by 77.5 per cent, with a maximum of 85 per cent being noted. A further reduction cannot be economically secured by digestion but can be eliminated by high trickling filtration.

The process involved use of a continuous up-flow digestion tank heated by exhaust steam to maintain the temperature. The trickling filters are shallow and work best when recirculation is maintained at a 50 per cent ratio. Gas produced in digestion amounts to 6 cu. ft. per gal. of waste and contains 80 per cent methane. Sludge produced is small in amount and overall B.O.D. reduction is from 92 to 95 per cent.

### *Waste from Whiskey Distillation*

The whiskey production industry was technically dead for many years before it was legally dead, and all improvements in the process and in waste treatment are of the last decade. This was the theme of the paper by Dr. C. S. Boruff, Technical Director, Hiram Walker and Sons, Inc., Peoria. In Dr. Boruff's absence, the paper was presented by Dr. R. A. Rasmussen, Nutritionist in the Hiram Walker Laboratories.

Where formerly beer slop was dumped, its contents are now recovered. Stillage is drawn off, concentrated to 20 to 30 per cent solids, after which it is centrifuged. The solids are mixed with the solids from the still mash, dried and sold as cattle food. The liquid from the centrifuging is evaporated to produce distiller's dried solubles containing water soluble Vitamin B. The production of by-products in the next year will be upwards of 1,000,000 tons.

### *Food Canning Wastes*

N. H. Sanborn, Research Chemist, National Canners Association, Washington, D. C., said, in discussing **"Food Canning Waste Utilization,"** that the problem was complicated because it was seasonal, scattered among small plants, and met with reluctance of operators to spend money for waste treatment.

Some problems could be eliminated by using artificial drying; as, for example, in alfalfa and pea vines. Vines dried in this manner make good hay. Twenty-five per cent of tomato tonnage is waste, but the seeds can be recovered and used for oil.

Other foods which show recoverable by-products are asparagus, apples, ("apple honey"), apricot oils, peach pits for dynamite and charcoal; cranberry waste is valuable as a source of ursalic acid, and pears for vinegar.

Not all of these wastes can be treated economically at the present time, according to D. T. Sherow, Chemist, Stokely Foods, Indianapolis, in his discussion of Mr. Sanborn's paper.

### *Petroleum Wastes*

In a paper entitled **"Petroleum Waste Utilization,"** R. F. Weston, San. Engr., Atlantic Refining Co., Philadelphia, Pa., said that oil wastes are divided into four categories depending on their source, within the industry. These sources are production, refining, marketing, and transportation. Wastes from production are generally drilling muds, emulsions, and brine. The latter is generally disposed of by discharge into the sea or back into the ground. Only one plant practices recovery of the brine salts.

Refinery wastes are the most numerous and the most complex; including brines, free and emulsified oils, taste and odor producers, oxygen consumers, toxic substances, and acid, alkaline, and color producing substances. These wastes are generally high in B.O.D. running up to 200,000 ppm. and are generally hard to separate. Waste treatment has been successful in many instances, with the waste treatment being developed along with the new process. One of the most spectacular recoveries is that of the 1,000,000 tons of acid now being recovered yearly from acid sludge.

### *The Fish's Point of View*

**"Industrial Waste and Fish Life"** was the topic presented by Dr. M. M. Ellis, Sen. Aquatic Physiologist, U. S. Dept. of Interior, Fish and Wild Life Service, Columbia, Mo. Whereas others, interested in industrial waste disposal and pollution, have the viewpoint of the industrialist, the health department, the economist, or the engineer and chemist, Dr. Ellis is, in the words of W. H. Wisely, "the man with the fish's point of view."

For Dr. Ellis knows, and told his audience, about the environmental limitations of the fish, and how trade wastes disturb these limitations. For example the fish has a poor pumping unit for his blood stream, his gill tubes are easily clogged, are easily anaesthetized, and are limited to life in water. The fish lives in a poorly buffered solution with a low oxygen concentration—(only 1/3000 to 1/7000 that of man). It must be remembered, said Dr. Ellis, that "a fish dies only once." Therefore, one can not look at averages as far as the fish is concerned.

Substances which cover the aquatic vegetation on the bottom of the stream may cause an aquatic "desert" and thereby cause fish to die out. Wastes which demand oxygen may be severe on fish even when the D.O. is not reduced below 5.5 ppm. if the pH is low at the same time. Mere survival of the fish is not the whole story. Perhaps a fish will live in a polluted stream, but it may no longer reproduce.

Dr. Ellis gave other information on the effect of various wastes on fish and the conditions under which these wastes were most harmful. These included acid wastes, brines, oils, and toxic substances.

### *Mine and Steel Wastes*

The study of and recovery prac-

tices now utilized in **"Mine Wastes and Steel Wastes"** were discussed by W. W. Hodge, Dean, College of Engineering, University of West Virginia, Morgantown, W. Va. Dean Hodge, who inaugurated the study of pickling liquor wastes at Mellon Institute for the Iron and Steel Institute several years ago, told of the studies that had been carried on since and of the progress made in the various treatments, several of which had been mentioned earlier by Mr. Wise of Conn.

Dean Hodge also told of the extent of the acid mine waste from abandoned mine drainage, and how millions of tons a year of sulfuric acid and iron were being carried into the streams. The mine sealing program, particularly in Pennsylvania and along the Ohio and its tributaries, has greatly reduced this pollution load and in many cases returned the local streams to essentially natural conditions. By sealing the mines to prevent the entrance of oxygen, the sulfur in the coal-bearing layers is not oxidized to sulfuric acid and solution of the iron and discharge of acid are, thereby, prevented.

### *Stream Pollution and Industrial Wastes*

The following are excerpts from the talk by Joe L. Quinn, Acting Director, Bureau of Environmental Sanitation, Indiana State Board of Health, and Technical Secretary of the Indiana Stream Pollution Control Board.

The waste being discharged through the sewers by industries is enormous and the Stream Pollution Control Board and the Indiana State Board of Health believe in the philosophy of "impelling rather than compelling compliance with existing laws," said Mr. Quinn. In consequence, the industries had been asked to participate in this conference on waste utilization, in order that the most benefit could be derived from the expenditures that will be made in controlling pollution.

Professor Wiley has offered the Sanitary Engineering Research facilities of Purdue through Professor Bloodgood to help solve this problem. The various state agencies will assist in any feasible manner.

The elimination of industrial wastes from the streams of this country is such an important problem from the standpoint of health, recreation, conservation and welfare that immediate consideration, suggested Mr. Quinn, should be given by the various manufacturers' associations to ascertain whether equipment costs for this purpose can be included, by amendment, in the deductions of federal income tax payments.

With 1,218,691 or 56.5 per cent of Indiana's people normally having access to municipal water supplies subjected to polluted sources serving 35 of the 46 surface municipal supplies, the potential health hazard is rather alarming. Although many consider only the agricultural accomplishments of the state, the industrial rank must be recognized. Mr. Quinn revealed that, in 1943, Indiana ranked second with a pack of 14,000,000 cases of Number 2 cans of canned goods from its 238 canneries; fifth with the production of 5,320,000 head of hogs, and fifteenth with 1,932,000 head of cattle, both of which support the operation of 231 meat-packing establishments; fifth with 211,314,000 bushels of corn and much other grain which helps support the operation of seven distilleries and thirteen breweries; twelfth with the production of 3,539,000 pounds of milk products supporting 600 milk processing plants; fifteenth with 5,273,000 barrels of oil from 1,781 wells; and sixth with the production of 25,175,000 tons of bituminous coal from 302 mines; all of which have a direct bearing on the location of 65 major industries of miscellaneous types.

Among those who presided at the sessions were Prof. R. B. Wiley, Head of the Civil Engr. School of Purdue; C. K. Calvert, Supt. of Water Purification, Indianapolis Water Co., L. F. Warrick, State San. Engr. of Wisconsin, Dr. George E. Symons, Assoc. Editor, *"Water Works and Sewerage,"* New York City; and A. A. Potter, Dean of the Schools of Engineering of Purdue University.

## A Praiseworthy Book on Stream Sanitation

*STREAM SANITATION* by Earle B. Phelps, Professor Emeritus of Sanitary Science, Columbia University, with a chapter on Stream Microbiology by James B. Lackey, Senior Biologist, U. S. Public Health Service, is a book on the unique study and discussion of the principles and problems involved in the pollution and self-purification of streams.

The book is more than that. For any engineer, chemist, bacteriologist, or administrator interested in water purification and sewage treatment, it is a volume that adequately and aptly presents the theory and principles of sewage treatment and the processes concerned therewith.

This broader application of the book is possible because, in his treatment of the chemical and biochemical phases of stream pollution and self-purification, Professor Phelps has explained the phases in terms of sewage treatment processes. For example, in the chapter on the "Aerobic Decomposition; Oxidation," the whole mechanism of biochemical oxygen demand and its satisfaction in trickling filters and activated sludge plants is explained.

Likewise in the chapter on "Anaerobic Decomposition; Digestion," the biochemical changes taking place in the sludge deposits in streams are explained in terms of what takes place in the sludge digestion tanks of a sewage treatment plant.

In presenting the subject, Professor Phelps has drawn on his early and valuable association with the United States Public Health Service, and particularly the work done at the Cincinnati laboratories of the USPHS as well as his long experience in the field.

While in places Professor Phelps has, as he puts it, blended the whole with "a dash of the 'queen of sciences,' mathematics," he does not burden the reader with this treatment of the subject. As a matter of fact, those unversed in mathematics can look at the formulas, appreciate the fact that the subject does have such scientific basis, and proceed through the text without being hampered in his understanding.

Chapters other than those mentioned include "The Life History of a Stream," a fascinating survey of the topic; the "Biology of Growth and Decay," a chapter fundamental in its concepts, and simple and understandable in its presentation; The "Oxygen Balance"; and "Public Health Aspects and Bacterial Pollution."

This book will make a valuable addition to the sanitary engineer's library, and should be required reading by students of sanitary science. It could easily be outlined and serve as the principal basis of a course of lectures on the subject.

Priced at $3.25, "Stream Sanitation" contains 276 pages and is published by John Wiley & Sons, Inc., New York.—(G.E.S.)

# WATER AND SEWAGE PATENTS

(OF RECENT ISSUE)

## WATER PATENTS

**Liquid Meter.** William A. Melas (to Cochrane Corp.). U. S. 2,359,927. Oct. 10. A system for measuring rate of flow of liquids.

**Filter.** Arthur Gordon, Chicago, Ill. U. S. 2,359,985. Oct. 10. A mechanical filter consisting of three sections the first half of the filter is for downward passage of the liquid the third quarter allows for upward passage from the first half, and the fourth quarter receives the flow from the third quarter for downward filtration with a U-tube discharge to maintain the level of liquid in the filter at some point above the filter surface.

**Water Treating Plant.** Walter H. Hinsch (to Dearborn Chem. Co., Chicago, Ill.). U. S. 2,359,991. Oct. 10. A wayside water softening plant with automatic measurement and control of reagents for use along railroad right-of-way.

**Pumping Apparatus.** Harry H. Burton, Worcester, Mass. U. S. 2,360,038. Oct. 10. Air lift pumping apparatus.

**Water Conditioning Product and Process.** Wesley E. Brittin (to Permutit Co., New York). U. S. 2,360,195. Oct. 10. A method of preparing a water-insoluble anion exchange product by treating humic material derived from the natural decomposition of vegetable matter with nitric acid under controlled conditions.

**Process of Producing Alkali Metal and Alkaline Earth Metal Hypochlorites and Alcohol.** Charles A. Hampel (to Mathieson Alkali Works, Inc., New York). U. S. 2,360,492. Oct. 17. A process for producing alkali earth metal hypochlorites from alkyl hypochlorites in the vapor phase, and concurrent production of alcohol.

**Process of Treating Water for Steam Boilers.** Geo. W. Smith, Pittsburgh, Pa. U. S. 2,360,730. Oct. 17. A phosphate treatment of boiler water to prevent deposition of calcium salts.

**Centrifugal Pump.** DeWitt E. Yates (to W. S. Darley Co., Chicago). U. S. 2,361,521. Oct. 31.

**Purification of Water.** Hubert L. Olin, Iowa City, Iowa. U. S. 2,362,022. Nov. 7. A process for clarifying water involving the use of sodium bentonite prepared as a sol in a small amount of water and mixing the sol with the water to be purified and adding a coagulant to precipitate the bentonite sub-flocs.

**Means for Measuring Pipe or the Like.** Julius E. Levin, Chicago, Ill. U. S. 2,362,907. Nov. 14. A gage allowing for three points of contact with any cylindrical object and a scale to indicate the diameter thereof.

**Water Treatment Apparatus.** Lee G. Daniels, Rockford, Ill. U. S. 2,363,167. Nov. 21. A zeolite softening apparatus with brine tank connected, meter, valves, and actuating mechanisms for regeneration.

**Method of and Apparatus for Treating Boiler Water.** Cyrus W. Rice, Pittsburgh, Pa. U. S. 2,363,622; Nov. 28, 1944. A method supplying a thick viscous boiler water treating compound to a boiler water system.

**Method of Treating Waters and Composition Therefore.** Wayne L. Denman (to Dearborn Chem. Co., Chicago, Ill.) U. S. 2,363,921; Nov. 28, 1944. An antifoaming boiler water compound employing an aliphatic ketone of at least eleven carbon atoms.

**Antifoam Composition for Aqueous Baths.** Wayne L. Denman (to Dearborn Chem. Co., Chicago, Ill.) U. S. 2,363,922; Nov. 28, 1944. (Appl. 3-1-38.) An anti-foam composition comprising an aliphatic ketone of at least eleven carbon atoms in combination with a dispersing agent of tannin and bentonite and a boron containing compound.

**Method of Purifying Waters.** Wayne L. Denman (to Dearborn Chem. Co., Chicago, Ill.) U. S. 2,363,923; Nov. 28, 1944; (Appl. 3-1-38). An anti-foam agent comprising a mixture of saturated and unsaturated aliphatic amines of high molecular weight and at least eleven carbon atoms in the aliphatic radicle.

**Purifying Water with Stabilized Emulsion.** Wayne L. Denman (to Dearborn Chem. Co., Chicago, Ill.). U. S. 2,363,924, Nov. 28, 1944; (Appl. 7-12-39). A stable anti-foam agent for treating water comprising a chemical produced by the reaction of a tannin and a boron containing compound.

**Means for Treating Fluid.** Clair V. Swearingen, Chattanooga, Tenn. U. S. 2,364,488; Dec. 5, 1944; (Appl. 5-23-41). A chemical feeder for treating water, comprising a reciprocating pump treating chamber and means for adding water treatment chemicals.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents he should obtain printed copies of the complete patent, at 10 cents each, from the Commissioner of Patents, Washington 25, D. C.

## SEWAGE PATENTS

**Sedimentation Apparatus.** Charles H. Scott (to The Dorr Co., New York). U. S. 2,360,817. Oct. 17. A sedimentation apparatus in which the sludge removal scrapers are operated from a vertical rotary shaft, powered by a centrally located drive mechanism and all necessary appurtenances.

**Purification of Liquids.** Earl M. Kelly and Arthur M. Kivari (to Dorr Co., New York). U. S. 2,360,811. Oct. 17. An apparatus and process for treating sewage bearing suspended solids and dissolved gases in a partial vacuum which causes a release of tiny gas bubbles which attach themselves to sewage solid particles thereby causing them to float and making for more easy removal. U. S. 2,360,812. Oct. 17. Process for treatment of waste liquids having oxygen demanding liquids and suspended solids by treatment to remove said particles in a closed vessel operating under a reduced pressure, removing flotable solids therein and treating the liquid discharge on biological trickling filter beds.

**Multiple Hearth Furnace.** Warren S. Martin, Massapequa, N. Y. U. S. 2,361,557. Oct. 31.

**Process for Treatment of Nitrotoluol Waste Liquors.** Ralph A. Hales, Ernest G. Almy, Aubry A. Young and Carl D. Pratt (to Atlas Powder Co., Wilmington, Del.). U. S. 2,362,066. Nov. 7. Treatment process consisting of controlled evaporation during course of which the pH is controlled by addition of caustic until solids content is 30 per cent, and thereafter igniting by passing through a dryer and furnace, such that ignition takes place before the solids become dry and explosive.

**Sewage Treatment Process and Apparatus.** Johanna Gunz (to Infilco, Inc., Chicago, Ill.). U. S. 2,363,176. Nov. 21. Equipment and apparatus for carrying on the activated sludge process.

**Filter.** Harry W. Denhard (to United Oliver Filters, Inc., Oakland, Cal.). U. S. 2,363,840; Nov. 28, 1944; (Appl. 1-3-44). On a rotary vacuum filter a method for removing the cake and for washing the cloth.

**Gas Holder.** John H. Wiggin, Chicago, Ill. U. S. 2,363,565; Nov. 28, 1944; (Appl. 11-1-40).

## *Two ★ ★ ★ ★ ★ Developments*

SOME months it seems difficult to pick what appeals as the most pertinent topic on which to base an editorial, and there results a certain amount of drag to the well known editorial pencil. Some months the thoughts that come to the editor do not seem to justify the use of the now precious paper space required to put them into circulation, nor the readers' time to peruse them if printed. Therefore, some months, as our readers know, this page is consigned to better use than for our enforced editorial which may say too little of sufficient import to justify it. This month, however, the situation is different and the editorial pencil is literally lubricated with oil of anticipation—anticipation of what the significance of two developments featured in this issue may ultimately lead to in raising the standards of water works operation and the upgrading of morale and establishment of goals of attainment for employees of municipally operated utilities.

The first development in question makes, in our minds at least, the biggest piece of NEWS that has come this way during our publishing experience. Reference is made to the story from Arthur P. Kuranz, Sup't. of Water at Waukesha, Wis.—News of that radical departure in municipal water utility operation and management just put into effect by the Water Utility Commission of Waukesha, for a two-year test period. This all started with the recommendation of a utility manager of vision, perspicacity, business acumen—and, shall we say, also an ability in salesmanship. We, in fact, felt an urge to carry something of this sort on the front cover of this issue and also as the caption to the Waukesha story up front in this issue—

**FLASH—Publicly Owned Water Utility Adopts Employee Profit-Sharing Plan!!**

In any event, that's how we felt about this innovation in water utility management, which we earnestly hope will make history in water works management. Not only did the lay members of the Waukesha Water Commission agree to the introduction of this hitherto unheard of incentive plan for a publicly owned water works, but the Mayor of Waukesha and a liaison member of the City Council agreed to the soundness of the policy and plan. Thus the decision was unanimous—the unheard of a reality.

In private conversation with Manager Kuranz, it has been learned that since notification of the water utility employees that they are henceforth "partners in the business" of the water supply service to their community, there has already been evidenced an attitude toward certain jobs in the utility which is not only interesting but adequately re-assuring that the profit-sharing plan is to accomplish what its proponents have predicted for it. For example, if some of a man's profit is running down the sewer from a badly leaking water main he is not likely to let it continue longer than he can help it. If he sees a fellow worker scrapping something which costs "his business" money and still may have useful life or renovation values, he is less likely to say "Sure the City has got plenty of money—why should we wear out our fingers or patience trying to save a few cents worth of stuff." At the cage the clerk will explain with more patience, and a less false smile, when realizing that some little part of that particular bill will come his or her way in the profit-sharing process. Similar possibilities are multitudinous as we see it.

Well, those are just some of our thoughts anyway. There are indications already and when those bonus checks are passed out about a month hence on 1944 net profits, we can see something of a staccato impetus to employee reaction in the Waukesha Water Department—pardon us, Municipal Water Utility is the correct, and deserved, term to apply to such a business-like operated, municipally owned water works as that of Waukesha.

And this new employee incentive scheme is now added to Waukesha's Salary Savings Plan, which the Water Utility established 7 years ago in the interest of water works employees—an insurance-backed retirement fund to which the utility has contributed two-thirds while the employer has deposited one-third in the interest of the employee as an individual, whether he remains with the Water Utility or leaves.

If all of this sounds to any reader as illegal procedure or "impossible" in *his* community—we would say, don't accept that concept but, instead, follow the legal procedure of looking back for an established precedent and go into "court" with the "Waukesha Case" as a reference.

Now, as to the second development, we point to the new "Code of Practice," adopted as the official code for members by the AWWA Board last month. We consider this a remarkably fine and laudable document developed by Secretary Jordan. The code is reproduced in this issue under the caption "AWWA Board Actions," and copies have gone out to all members of the Association. Our thoughts are that the greater the publicity given to this document the higher will be the regard of the general public toward the water-works man. It should be displayed, in readable sized lettering for framing, by hanging it in every water utility office and in the collection lobby—perhaps not one but two copies in each public lobby. Subscription to such a laudable and finely expressed code as is the AWWA Code for Members should be a part of every application for membership in AWWA. A framable sized print should go with each new membership—and, extra copies supplied at just cost to the Association. Every newspaper editor should be given the opportunity of learning what the water-works man's code is, and of letting his community know in turn under such a caption as—"Service to the Community Above Self!"

L. H. Enslow

# MEETINGS SCHEDULED:

**IMPORTANT**

It will be noted that a few of the conferences listed below have been cancelled as the result of the directive issued by the Federal War Committee on Conventions early in January. Others may be cancelled, and this list must be considered as tentative for the present.

A.W.W.A.'s Annual Conference, which was scheduled for St. Louis, has been indefinitely postponed (temporarily cancelled) awaiting decision of the War Committee on Conventions on or before March 1st.

The Sewage Works Federation, whose annual conference had been scheduled for early September in Toronto, Ont., expects to petition the War Committee on March 1st for authorization to hold the Toronto conference.

Meetings, conferences, short schools, which will require hotel rooms or sleeping car reservations for no more than 50 persons are considered as local or sectional meetings, and a permit or application to hold such meetings is not required. Therefore many conferences and short schools can be held as planned.

Mar. 9-10—MINNEAPOLIS, MINN. (Nicollet Hotel).
**Minnesota Section A.W.W.A.** Sec'y-Treas., R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

Mar. 12-13—CHICAGO, ILL. (LaSalle Hotel).
**Illinois Section A.W.W.A.** Sec'y, O. T. Birkeness, 809 Washington Blvd., Chicago 7, Ill.

Mar. 15—BOSTON, MASS. (Hotel Statler).
**New England Water Works Association.** Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Mar. 15-16—LAFAYETTE, IND. (Purdue Memorial Union Bldg).
**Indiana Section A.W.W.A.** Sec'y, C. H. Bechert, 402 State Library Bldg., Indianapolis 9, Ind.

Mar. 19-21
**Southeastern Section A.W.W.A.** (Cancelled)

Mar. 19-21—TORONTO, ONT. (Hotel Royal York).
**Canadian Section A.W.W.A.** Sec'y-Treas., Dr. A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

Mar. 22-23—TRENTON, N. J.
**New Jersey Sewage Works Ass'n** (30th Annual Meeting.) (Cancelled)

Mar. 29-31—SARASOTA, FLA.
**Florida Sewage Works Ass'n.** (Cancelled)

Apr. 5-6—COLUMBUS, OHIO (Hotel Fort Hayes).
**Ohio Section A.W.W.A.** Sec'y, L. J. Hoffman, 100 Municipal Bldg., Akron 8, Ohio.

Apr. 12-13—LEWISTON, MONT. (Hotel not selected)
**Montana Sewage Works Ass'n.** (First Annual Meeting.) Sec'y-Treas., Herbert B. Foote, State Board of Health, Helena, Mont.

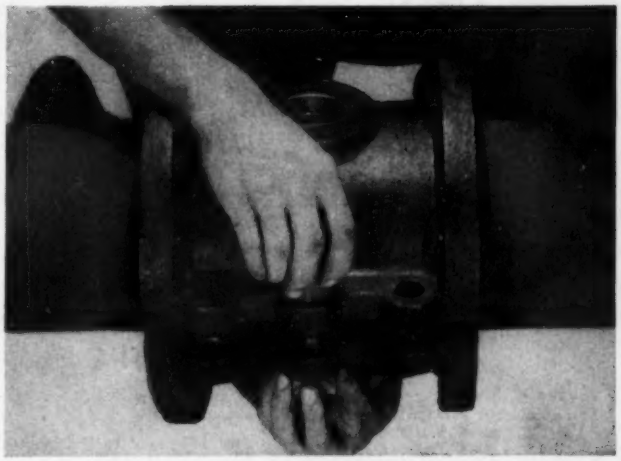
Apr. 13-14—LEWISTON, MONT. (Hotel not selected).
**Montana Section A.W.W.A.** Sec'y, H. B. Foote, Dir. Div. San. Eng., State Board of Health, Helena, Mont.

Apr. 19-20—ELMIRA, N. Y.
**New York Section A.W.W.A.** (Cancelled)

May 2—BOSTON, MASS. (Hotel Statler).
**New England Sewage Works Association.** (Spring Meeting). Sec'y-Treas., LeRoy W. VanKleeck, State Dept. of Health, Hartford, Conn. (Indefinitely postponed)

May 7-11—ST. LOUIS, MO.
**American Water Works Ass'n.** (Annual Conference) The St. Louis conference has been indefinitely postponed pending final decision of War Convention Committee. If not approved by March 1st, the conference will be permanently cancelled.


## For QUICK Repairs In Emergencies



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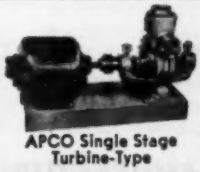

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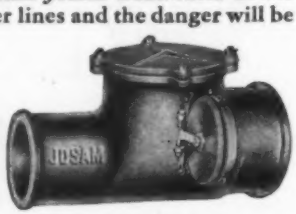


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May 18-19—GEARHEART, OREGON (Gearhart Hotel).
**Pacific Northwest Section A.W.W.A.** Sec'y, Fred Merryfield, Oregon State College, Corvallis, Ore.

June 8—(Meeting place announced later)
**New Jersey Section A.W.W.A.** (Spring Meeting) Sec'y, C. B. Tygert, Box 178, Newark, N. J.

Sept. — —TORONTO, ONT. (Date and hotel to be announced)

**Federation of Sewage Works Ass'ns.** (Annual Conference.) Exec. Sec'y, H. W. Wisely, 325 Illinois Bldg., Champaign, Ill. (Application to hold is to be filed with War Convention Committee, Washington, March 1st.)

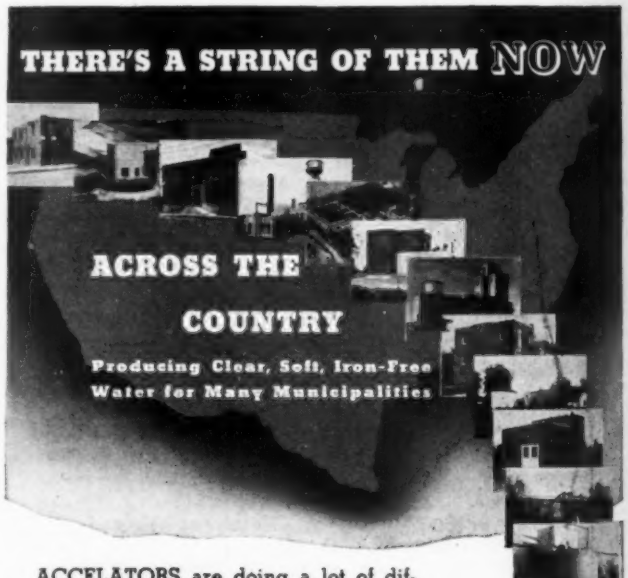
Sept. 12-13—FLINT, MICH. (Hotel not selected)
**Michigan Section A.W.W.A.** Sec'y-Treas., M. N. Gerardy, Dept. of Water, Water Board Bldg., Detroit 26, Mich.

Oct. 15-17—(Meeting place announced later)
**Southwest Section A.W.W.A.** Sec'y-Treas., George J. Rohan, Supt. of Water, Waco, Texas.

Nov. 5-7—CHARLOTTE, N. C. (Hotel Charlotte)
**North Carolina Section A.W.W.A.** Sec'y, D. M. Williams, Supt. of Water & Sewerage, Durham, N. C.

Nov. 8-10—ATLANTIC CITY, N. J. (Hotel Madison)
**New Jersey Section A.W.W.A.** (Fall Meeting.) Sec'y, C. B. Tygert, Box 178, Newark, N. J.


**THERE'S A STRING OF THEM NOW**

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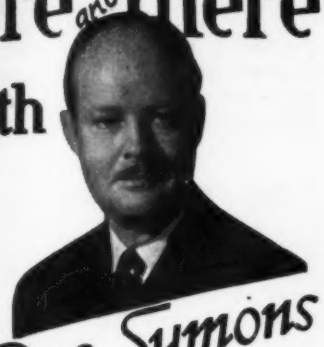
# Here and There with Doc Symons



IT WAS a year ago that this column did its version of an annual review. Now that another year has passed, let's look back over the 12 months and see what items didn't find column space at the time.

***February:*** I attended my first clam chowder and donut soiree of the Maine Water Utilities at Portland, and heard Scotty Marshall of Georgetown, Mass. (sponsored by Roger Esty of Danvers, Mass.) explain and demonstrate how the Highland Fling originated—Worth the price of admission!

***March:*** Saw Alan (Dorrco) Darby at the N. J. Sewage Works Assn. Meeting in Trenton, and he said he was inclined to agree with the idea the Canadians have in their system of no room entertainment at conventions.

Also attended the NEWWA meeting in Boston and heard "Sherm" Chase read a report of the *"Wasting Water Committee."* Should have read *Wartime,* in case you're wondering.

***April:*** Charlie Emerson told me he was working on the committee on a glossary of water and sewage terms —I hope the committee decides whether to spell it digester or digestor.

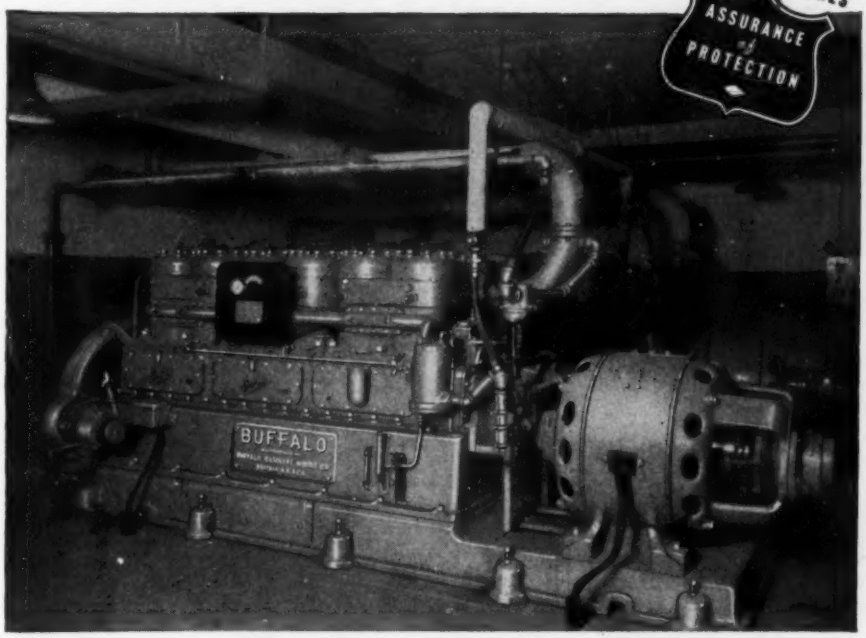
***May:*** Nothing happened that didn't make the "column" but I still think the best story of the year occurred at Columbus (Ohio Section Meeting), when Mr. Jones found seven lovely girls asleep in his room.—Remember?

***June:*** Heard the story of the Four Horsemen of the Rutgers University Short Course of 1927. At that first two-week short course ever held in the country for sewage plant operators Prof. Harry Lendall supervised the work and among the lecturers were John Downes, Dr. Rudolfs, Russell Riker, Wes Gavett, Morris Cohn, Paul Molitor, Sr., H. P. Croft, and others. Among the students were "The Four Horsemen", always together both in curricular and *extra*-curricular activities. What ever happened to them? There was A. B. Cameron, now supt.


REACHING ITS FULL LOAD

In 30 Seconds

BUFFALO ENGINES ASSURANCE of PROTECTION




*Model ATT—direct-connected to generator for emergency service—Western Union Telegraph Co., St. Louis, Mo.*

THE big thing that the buyer of a stand-by power unit wants is assurance of protection—but some extra benefits are important too.

For instance, in a public service such as the telephone or telegraph, a break longer than a half-minute isn't tolerated, and the motor speed and power delivery must be constant.

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The men who have been building and installing these engines for over forty years are at your service in providing information to help you plan your installation. Write for engine Specification Sheets for your files and for the answers to your questions on installation layouts.

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BUFFALO ENGINES ASSURANCE of PROTECTION

BUFFALO ENGINES — 100 H. P. THROUGH 750 H. P.— IN GENERATOR AND PUMPING SETS FOR WATER WORKS — AIRPORTS — COMMUNICATIONS — FLOOD CONTROL — HOSPITALS — INSTITUTIONS — MINES — MOVABLE BRIDGES — THEATRES — SEWAGE PLANTS.

# Good Neighbor Relations Begin *with* Good-Tasting Water

Everyone appreciates water that tastes good. Hydrodarco insures pure, odor-free, palatable drinking water. Hydrodarco, activated carbon is made especially for water purification. It is unequalled for low cost adsorption of the foreign elements that produce unpleasant tastes in drinking water.

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of Sewage at Jackson, Mich.; Daniel E. Davis, now with The Chester Engrs. in Pittsburgh; Norman J. Humason, now supt. of Filtration, Lorain, Ohio; and Willis J. Snow, now with the Connecticut State Water Commission in Hartford. Looks as though the Four Horsemen are still riding.

***July:*** I ran across a book review in the APHA Journal. The book was "Public Health and Preventive Medicine" by Morton C. Kahn. What interested me was the reviewer's comment, to-wit, "Under *Water*, no allusion is made to softening nor to taste, and odor control" (Don't tell Charlie Hoover or "Sig" Sigworth) and "Orthotolidine is mentioned under *Sewage* but not under *Water*." (Dr. Kahn apparently never heard of Messrs. Griffin and Chamberlain, either.)

***August:*** Sam Ellsworth, on whom I often counted for an item, passed away leaving me one fifty-five cent word, "Interrogatory" — that being, said Sam, diplomatic parlance for "questionnaire."

***September:*** At the costume ball of NEWWA at Poland Spring, the best dressed "lady" there was Attmore E. Griffin, accompanied by his date, Charlie Eastwood. And the picture (shot by Ed Rothman) of "Griff" entering "milady's bawth" really rates a private showing.

***October:*** Federation Meeting in Pittsburgh—Last of the older generation of sanitary engineers, J. N. Chester, who registered and attended the sessions. A salute to the gentleman, who, alone, represents that group of men who founded and fathered sanitary engineering in this country two generations ago.—Rumor going around Thompson's Restaurant to the effect that George Schroepfer is developing into an excellent understudy for Milt Rosen's ice-man act at conventions.—And they were telling the story about the Great Lakes Treatment Plant where, over the final tank, there is a sign reading, "No Swimming Allowed." Too many boot trainees had never seen a swimming pool or a sewage treatment plant, either.

***November:*** Had the experience of presiding at a session of Purdue's Industrial Waste Conf. without having had the opportunity to meet or talk with the persons I was to introduce. I took a chance and used hand signals (five fingers to indicate five minutes left)—it worked. No one ran overtime, not even the introductions.—I changed the style of writing the literature and catalog items in the back of the book, trying to lift a little of the

heaviness therefrom.—No kick from the readers—or the editor.

***December:*** From our circulation department I learned that the Georgia Water and Sewage Assoc. had made its annual awards to two members. How did the Circ. Dep't know?—because each award consists of a one year subscription to *W.W.&S.*—One went to Stewart Brown, Sup't of Water Dep't, West Point, Ga., and the other to Henry Knapp, Sup't of Intrenchment and South River Sewage Plants in Atlanta, Ga.

Linn Enslow gave me a book to read entitled "Life Insurance From the Buyer's Point of View" and it has so much good "stuff" in it, I've decided to write a review of the book for the next issue.

Had a letter from "Rollie" Leveque saying he'd look for "drool" marks in this column after I'd seen the 1945 Omega calendar he sent. (Woof-Woof!)

***January '45:*** At the annual luncheon of the N. Y. State Sewage Works Assoc., the past president's key was presented to the "Outgoing" by the "Incoming" with the following bit of verse (?):

"Last year 'twas a fellow named Larkin
To whose words the boys all did hearken,
While he sat in the chair,
Dispensing hot air,
And grew broad in the beam by his parkin'."

First limerick I ever wrote (sounds like it, doesn't it?)—But Bill wanted a copy of it, so there 'tiz.

*News heard during the month.* Malcolm Pirnie, past pres. of ASCE, is chairman of the C.E.D.'s Construction, Action, and Advisory Committee.—Charlie Spaulding, who has been with the Army Engineers at Ft. Belvoir, Va., since June 1943, has gone back to his consulting practice in Springfield, Ill.—Neil F. Kershaw, formerly of Indianapolis, is now with the Fifth Service Command.—W. D. Gerber, longtime Engineer of the Ill. State Water Survey, retired last Fall and in December Dr. A. M. Buswell returned from active military service to take up his duties as Chief of the Survey, and relieved Jess Woltmann of Bloomington, who has been pinch hitting.—Joe Rehler is now a full Commander in the C.E. Corps of the Navy and is on his way overseas. Joe was a j.g. when he left the Olean, N. Y., water plant for service in 1941.—The mystery of who is that consulting engineer of Harrisburg, Pa., was cleared up. Turned out to be Ivan Maxwell Glace, who gave me a new mystery to worry about—But more of that next month.—Herb Hartung is now Plant manager of the St. Louis County Water Co., having been appointed to fill the vacancy made when Vance Lischer joined Horner and Shifferin, Cons. Engrs. in St. Louis.

And, as my favorite jester, Buffalo Bodie, says "That's all, chum!"

*Clayton Pressure Reducing Valve*
*1" to 4" Sizes, Screwed Ends*
*2" to 16" Sizes, Flanged Ends*

**The Clayton Pressure Reducing Valve is a necessity on every line where discharge must be maintained with minimum fluctuation, regardless of varying pressure on the inlet side. This Clayton Valve reduces and regulates line pressure to any required delivery pressure. It closes automatically against line pressure in a smooth, positive manner, eliminating surges in delivery pressure and "shock" or "water hammer" on inlet lines. Its exclusive design makes it ideal for dead end service.**

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**REPRESENTATIVES IN PRINCIPAL CITIES**

**VALVE DIVISION**
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*"Feather Touch" CONTROL*

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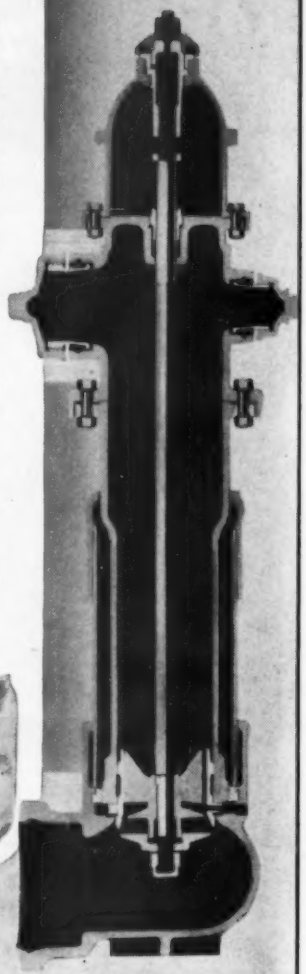
The "innards" of a Mathews are as snug as a bug in a rug. A roof-like operating nut acts as a shield, preventing rain, sleet, snow, or hose spray from seeping in and freezing. A stuffing box keeps internal water away from the threads. An automatic drain-valve drains the hydrant dry after use.

These features are typical of the thought and care with which every detail in a Mathews Hydrant has been worked out to provide years of dependable, economical fire protection. If you are considering hydrants for your community, be sure to send for a detailed description of what Mathews Modernized Hydrants have to offer.



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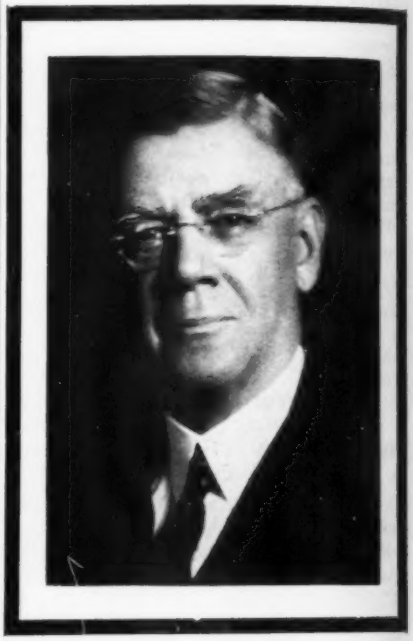
# MANUFACTURERS' and EQUIPMENT News

## Kingsley of Niagara Alkali and E. B. G. Passes

Pioneered Liquid Chlorine in 1907.



"Ned" Kingsley

Edward Dickinson Kingsley, chairman of the Board of Niagara Alkali, and best known as pioneer in the introduction of liquid chlorine into America, died on January 1, 1945, in his New York residence at the age of 84.

Early in 1907 "Ned" Kingsley, as he was best known in the chemical field, organized the Electro-Bleaching Gas Co., of Niagara Falls, N. Y., for the purpose of manufacturing and distribution of the then little known liquified chlorine gas. Through his vision, and that individual ruggedness for which pioneering Americans are so well known, he was successful in converting that troublesome by-product of the electro caustic-soda industry into a highly useful primary product.

This modest start in the chemical field was the forerunner of his ac-

quiring in 1915 the Niagara Alkali Co., of Niagara Falls, N. Y., which produced a line of heavy chemicals and, later, the Pacific Lime Co., Ltd., of Canada, The Kingsley Navigation Co., Ltd., of Canada, and the Kingsley Navigation Company of Califor-

Kingsley's First Cylinder of E.B.G. Liquid Chlorine—the 1907 "Curiosity" of the Chemical Industry.

nia. These companies he headed as President until 1941 when he retired from active management and was elected Chairman of the Board of Niagara Alkali and turned over active management to S. W. Jacobs, once a water plant chemist, as his successor.

Mr. Kingsley was a member of The Chemists Club of N. Y., the Niagara Club of Niagara Falls, the American Chemical Society, and the Electrochemical Society. He is survived by his widow of Chappequa, N. Y., and N. Y. City.

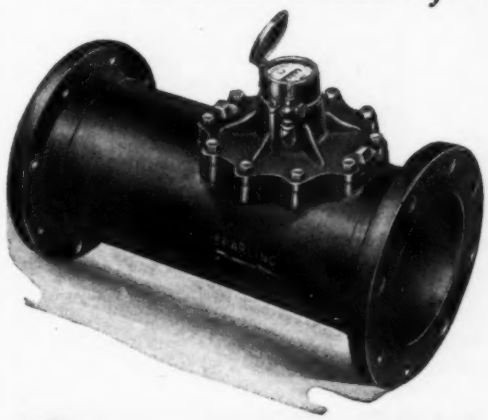
At its recent annual meeting The Chlorine Institute of N. Y. eulogized the pioneer, the leader and "the man" — "Ned" Kingsley — who became highly respected and beloved by associates and competitors alike. In the application of chlorine in the


# SPARLING MAIN-LINE METERS

**Types for all Main-Lines**

*Sparlings measure the 16-Foot Jobs at CHICAGO's South Side Filtration Plant*

*and 2-Inch Mains from Coast to Coast*



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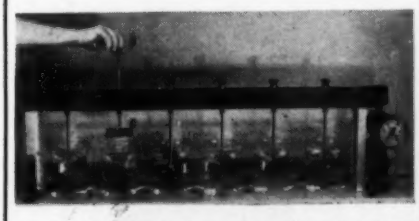
THE *Phipps & Bird* LABORATORY MIXER . . .



IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

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**REX AERO-FILTER**

The high efficiency of the REX Aero-Filter is proved again by operating data obtained from the Detroit Lakes, Minnesota, Sewage Treatment Plant. Plant units are: REX Bar Screen and Triturator, Fine Screen, REX Aero-Filter, Imhoff Intermediate Tank, Low capacity secondary Filter and REX Conveyor-Type Final Settling Tanks.

With BOD loadings in excess of 4000 lb. per acre ft. of media, 87% removal through Aero-Filter and intermediate clarifier is obtained. Overall plant efficiency is better than 95% with an average effluent of 12 p.p.m. BOD.

The combination of Aero-Block media and the REX Aero-Filter distributor allows high BOD loadings without loss of efficiency.

Rex maintains a staff of experienced sanitation engineers to help you with your waste treatment problems. Write for complete information on REX Aero-Filters and the other types of efficient Rex Sanitation Equipment. Address Chain Belt Company, 1610 West Bruce Street, Milwaukee 4, Wisconsin.

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**CHAIN BELT COMPANY *OF MILWAUKEE***

*Member of the Water and Sewage Works Manufacturers Association, Inc.*


water and sewage field, Mr. Kingsley took an early interest and controlled the basic patents, granted Dr. Geo. Ornstein as an E. B. G. employee, covering the process of chlorinating with the gas instead of bleaching powder, the then accepted chlorinating agent.

## "Bob" Quinn Heads Compressed Gas Mfrs. Ass'n

Another boy from Illinois became a gavel wielder last month when Robert J. (Mathieson Alkali) Quinn was elected president of the Compressed Gas Mfrs. Assoc., Inc.

Mr. Quinn, the newly elected president (better known as "Bob" among water and sewage-works men), is

"Bob" Quinn

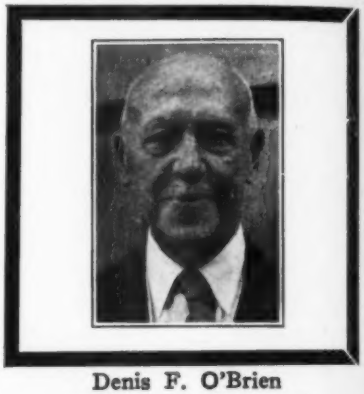
Assistant to the Vice-President in Charge of Sales for The Mathieson Alkali Works. He received his chemical engineering degree from the University of Illinois in 1912 and joined the Mathieson organization in 1920 as Western District Sales Manager in Chicago. In 1923 he became Assistant Sales Manager in the New York Executive Office, and in 1942 was appointed to his present post.

He is a member of the Board of Governors of the Water and Sewage Works Mfrs. Association, representing Mathieson in this capacity because of his especial interest in water supply and sewage disposal.

## Denis F. O'Brien Passes

**Long Time Head of A. P. Smith Co., Suffers a heart attack in 81st Year**

Denis F. O'Brien well known manufacturer and head of the A. P. Smith Mfg. Co. passed away suddenly on the morning of Jan. 31, after having worked late the night before.



**Denis F. O'Brien**
*"A Prince of Commerce"*
*Three Times President of Mfrs. Assn.*

Mr. O'Brien would have been 81 years old this year.

Well known as the guiding genius of the A. P. Smith Mfg. Co. of E. Orange, N. J., Mr. O'Brien had been Gen. Mgr. from 1896 until 1908 when he was elected president of the company, a position he held until he was elected Chairman of the Board in 1941.

Mr. O'Brien patented and developed many types of valves, valve inserting machines and fire hydrants, including the "O'Brien Hydrant" which remains the standard in many of the principal cities in this country.

Denis O'Brien was elected an honorary member of the AWWA in 1935. He has served as a director from 1930 to 1939 and again from 1940 to 1943. Mr. O'Brien, who came to this country as a young man from Ireland, was active in the National Foundrymens Ass'n and the Water Works Manufacturers Ass'n, of which he was the first president in 1909-10, and of which he was again

president in 1926, and also in 1942, after the organization had been changed to the Water and Sewage Works Manufacturers Ass'n.

Denis O'Brien, who we have called "A Prince of Commerce," stood at the top in the estimation of all who knew him, and was beloved as few are by those who knew him at all well. His leadership in the manufacturing field stood for all that is fair and square. He lived by and practiced the golden rule. And, with a sense of all that was fine in life, Denis O'Brien will live on in the memories of his associates and host of friends. In the A. P. Smith Mfg. Co. his name lives on through the personage of his son, Hubert F. O'Brien, as president of this old line company organized in 1889.

## Sennet Made Chicago Manager for Ludlow Valve

**Succeeds Veteran Sybrandt Who Retires**

Well, the boys around Chicagoland will regret to learn of the retirement of John L. Sybrandt, for many years manager of the Chicago office of The Ludlow Valve Mfg. Co., Inc.

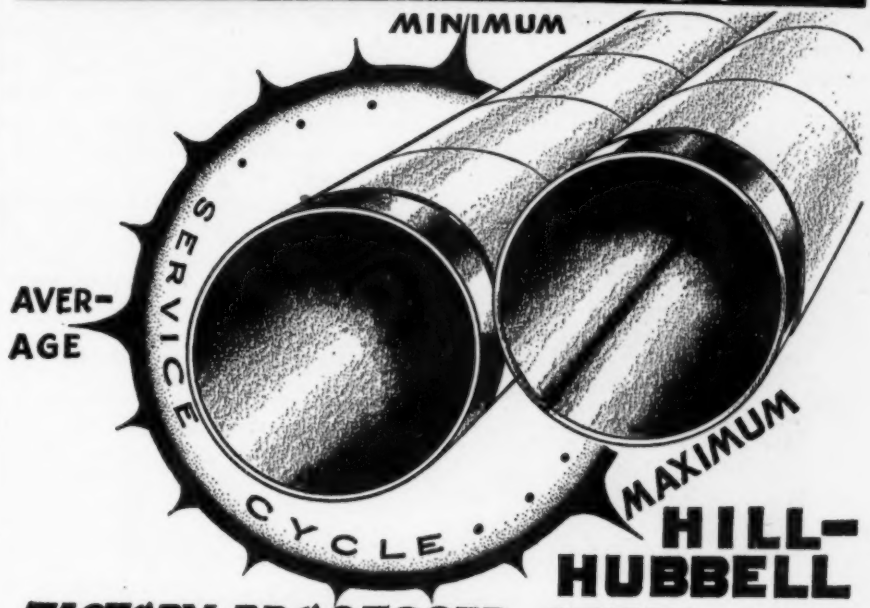
Mr. Sybrandt's position is to be filled by Lowell E. Sennet, an engineer with long and thorough experience in valve applications. Mr. Sennet was graduated from Case School of Applied Science, Cleveland, and has previously been with the engineering departments of the Grinnell and Crane Companies.

Lowell E. Sennet

## Dresser Acquires Three More Companies

Dresser Industries, Inc., Cleveland, Ohio, which recently reorganized and expanded under this name, has acquired three southern California companies; Day & Night Manufacturing Co., Monrovia, Payne Furnace & Supply Co., Inc., Beverly Hills, and Kobe, Inc., Huntington Park. The Dresser family now has thirteen operating members, several of which manufacture equipment for the water works and sewerage field.


What Steel Pipe Protection insures Longevity? ..

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HILL-HUBBELL factory processed steel pipe has dominate advantages for longevity of pipe installations.

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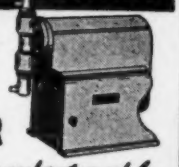

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## Alemite "Versatal" Pump

We wish we could show you a picture of Alemite's new "Versatal" pump in action but you'll have to be satisfied with the accompanying picture showing one model of these pumps, a radical departure in many

aspects from the conventional type of "pressure pot" spray apparatus.

Developed for applying a secret anti-fouling paint on ship bottoms, this new pump is designed to dispense and apply a wide variety of materials; including paints, lacquer, mastic, sealers, insulating materials, fibre, and cement coatings and caulking compounds, and "what have you." There are several designs, including two portable units, and more than one spray head may be operated from each unit.

Water and sewage plant operators should find these pumps useful in spraying anti-rust paint and rust preventives on equipment, or for paints, cement coatings, and caulking compounds.

Write Alemite, 1826 Diversey Parkway, Chicago, Ill., for Form 22-223 for more complete information on these very "Versatal" units.

## Ideal Auto Charger

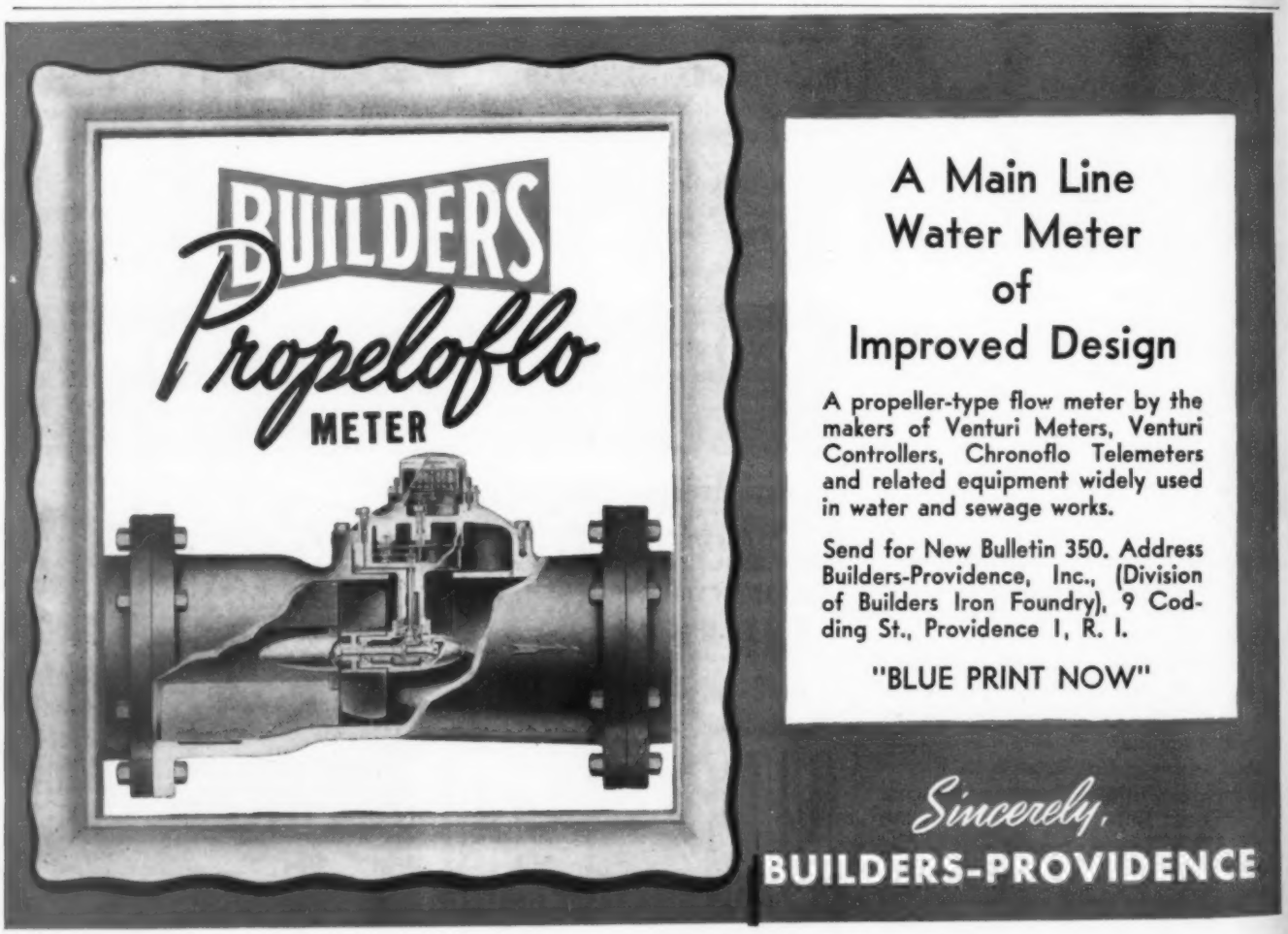
Wasn't it the Ideal Commutator Dresser Co. of Sycamore that first introduced the Rechargeable Flashlight Storage Batteries? Well, now they are introducing a new charger for these wet cell batteries, a charger that will work from the battery of a car, bus, truck, or motor boat. Attached to the live side of the ignition system, the charger may be operated when the car isn't operating. A small pilot lamp shows when the battery is charging. For more information on this new unit, write to the company at 1615 Park Ave., Sycamore, Ill.

## Rust Prevention With Texaco Rustproofs

In 1942 a friend of ours, who sells Texaco industrial oil, told us about four Texaco Rustproofs, and ever since that time we have been intending to look into the possibility of their application in the water and sewage field, and so we wrote for a bulletin on the subject.

About the same time we received a copy of Texaco's bulletin entitled "Rust Prevention with Texaco Rustproofs," we remembered that Ed Decher of the Joint Meeting Sewage Plant in Elizabeth, N. J., had once spoken glowingly of that material. While the bulletin explains the number of advantages of the rustproof compounds, and how and where it can be applied, we failed to find any mention of its use in the water or sewage industry. So we asked Decher for some information on his experience.

We think both you and the Texaco Co. will be interested to know that Mr. Decher has found that one coat of the material lasted several months on a mechanical screen which was alternately submerged and exposed to the air for long periods of time. The material has also been used with excellent results on the power and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A Main Line
Water Meter
of
Improved Design
A propeller-type flow meter by the makers of Venturi Meters, Venturi Controllers, Chronoflo Telemeters and related equipment widely used in water and sewage works.
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traction rails over the settling tanks, as well as other locations continually or intermittently in contact with water.

We believe this is the first application of this compound in a sewage treatment plant, and we also believe that it's worth looking into by other persons who have had corrosion problems.

## Worthington Pump Elects New Officers

The Board of Directors of Worthington Pump and Machinery Corp. recently elected Clarence E. Searle as president to succeed Harry C. Beaver, who was elected vice-chairman of the Board of Directors and chairman of Management Committee. Mr. Beaver has been president since 1931 and Mr. Searle vice president in charge of sales since 1932.

H. C. Ramsey

C. E. Searle

Hobart C. Ramsey, vice president in charge of operations, was elected executive vice president. Edwin J. Schwanhausser, vice pres. in charge of manufacturing and sales operations in Buffalo, was elected vice pres. in charge of sales. Leslie C. Ricketts, manager of the Harrison works, was elected a vice pres. All elections became effective on the first of the year.

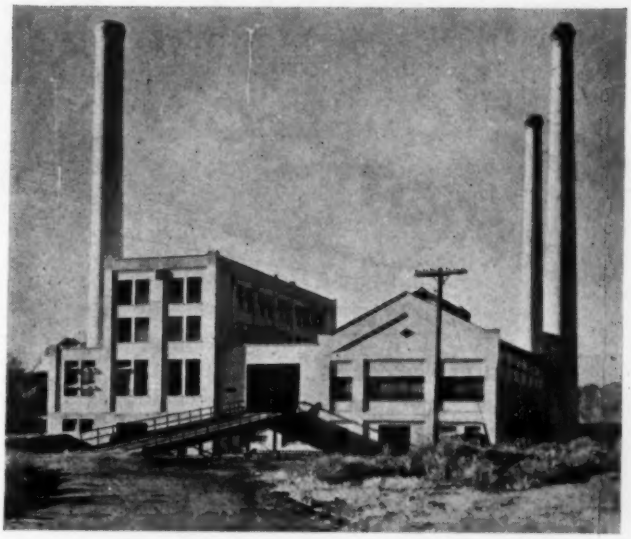
## Kurtz Joins Chain Belt

The accompanying photograph isn't too good, we'll admit, but maybe you can recognize Harold I. Kurtz, the new sanitary engineer on the staff of Chain Belt Co. Before taking up his new duties, Kurtz was in the

Harold I. Kurtz


HEAVY-DUTY INCINERATION

MORSE BOULGER DESTRUCTORS



Incineration plant at New Rochelle, N. Y., where population increases necessitated two additions to the plant's original capacity. The Morse Boulger Destructor Co. handled the original plant and the additions.

*Incineration — not just a Furnace!*

Any furnace can be called an incinerator but *any* furnace is likely to be only a furnace! Incineration is an engineering subject in itself . . . a subject in which Morse Boulger Engineers have specialized for years, paying particular attention to the destruction of municipal wastes.

Why not call on Morse Boulger for help in drawing up plans for a *really engineered* incineration plant—one that will be a credit to your community?

Send for Bulletin No. 110.

MORSE BOULGER DESTRUCTOR CO.
205-W EAST 42ND STREET NEW YORK 17, N. Y.
*Agents in all Principal Cities.*

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FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

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*A Filter Medium For All Purposes*

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HYDRANTS

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Symbol of Quality Since 1889

PROTECTOP

Trucks and motor cars back into fire hydrants every day. When this happens to a Smith Protectop Hydrant the break occurs at but one place and the only parts needing replacement are the frangible standpipe clamp and the frangible cast iron stem section. These parts cost comparatively little and full repairs can easily be made in 15 minutes. The valve is of the compression type and even should it be open at the time of the break, it will instantly close, preventing any possibility of flooding.
Made in all sizes and types.

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The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

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ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS
SPECIAL WATER TREATMENT EQUIPMENT

*We invite your inquiries*

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*

Bureau of Repairs and Utilities Branch, War Department, in the 4th Corps Area, and before that had some good experience as a Sanitary Engineer for the City of Butler, Pa., as well as chemist in the Bureau of Sanitation at Bluefield, West Virginia. He is a member of the American Chemical Society.

## Springer Graver's Eastern Manager

Announcement has recently been made of the appointment of Chas. W. Springer as Manager of Eastern Sales for the Graver Tank and Mfg.

C. W. Springer

Co., Inc., of East Chicago, Ind. Mr. Springer was formerly a Division Sales Manager with Jones and Laughlin Steel Co. and prior to that a representative of the Chicago Bridge and Iron Co. Mr. Springer will direct all of Graver's east coast sales activities from the company's offices at 424 Madison Ave. (17), New York City.

## Charlie Bray Returns to De Laval

Charles C. Bray has been appointed Asst. to the Mgr. of the Worm Gear Div. of the De Laval Steam Turbine Co. Prior to accepting this position, he served as a metallurgist for the Special Steel Dept. at Philadeiphia for Joseph T. Ryerson & Sons. Mr. Bray is not a newcomer to De Laval, having served for ten years as a worm gear sales engineer in De Laval's Chicago office.

Charles C. Bray

## Gardner-Denver Has New Export Division

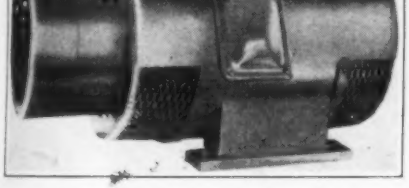
In order to take care of expanding export activities, Gardner-Denver Company has reorganized its Export Division. Mr. G. V. Leece, a vice president of the company, will manage the new export division from the office in the Woolworth Bldg. in New York City. Associated with Mr. Leece in the office are S. T. Brown, asst. mgr., and Harold Weber, asst. sales mgr.

## Ethel Klingman Made Asst. Adv. Mgr. by Penn Salt

Ethel Serfas Klingman has been appointed Assistant Manager of Advertising of the Pennsylvania Salt Manufacturing Co., chemical manufacturers, Philadelphia, Pa., effective January 1, 1945. She has been with the company for the past seven years and for the past two years has been Editor of *Contact*, one of Penn. Salt's house publications.

## New Small, A-C Generators

A new line of small a-c generators, of the revolving field type, has been announced by the Electric Machinery Mfg. Co., Minneapolis. Built



in ratings 6.25 kva, 1800 rpm and 1200 rpm to 18.7 kva, 1800 rpm; single and 3 phase; standard and close regulation; 120, 120/208, 240 and 600 volts; these generators can be supplied as 2-bearing units for belted or coupled duty, or single-bearing for close coupling to driving engine. Drip-proof generator and exciter construction is standard and there are several other advantages as well.

## New Service Emblem for Chicago Bridge and Iron

From the *Water Tower*, published by the Chicago Bridge and Iron Co. we learned of the new service emblem being presented to all employees who have been with the company over five years. The pin is an attractive item which shows the letters CB&I on an enamel background with the number of years service in a small box centered in the pin. Numerals indicate service in five year intervals, up to 20 years being in silver and above 20 years in gold.

One man, the president, Mr. George T. Horton, received a fifty year pin, five men received 45 year pins, seven have been with the company 35 years, twenty four have been employed 30 years while the list of 25, 20, 15, etc., grows proportionately longer. Long service of employees speaks well for both the company and the type of men it employs.

## Stars and More Stars

It is not of the movie stars of which we write, but of the growing number of stars appearing in the Army-Navy "E" flags of some of our manufacturers in this field. For example, there is Infilco, Inc., which has just received its second star, and Chain Belt of Milwaukee, which has received its third star, the Hooker Electrochemical Co. of Niagara Falls its fourth star (and


# COMPLETE SELECTION in Socket Fittings!

Sleeve (Solid) Fig. 521

Plug Fig. 523

Flanged Socket Fig. 528

Cap Fig. 524

⅛ Bend Fig. 507

¼ Bend Fig. 501

Tee Fig. 514

Cross Fig. 516

Reducer Fig. 526

Every type of socket fitting needed for water works construction and maintenance is included in Grinnell's line.

Special features of Grinnell Socket Fittings:

1. Improved design cuts size and weight and lessens friction losses.
2. All socket and spigot dimensions and wall thicknesses are the same as A.W.W.A. Standard Class "D" Pipe.
3. All fittings suitable for use with Super-deLavaud centrifugally cast Bell and Spigot Pipe.
4. Although listed for only 150 lbs. working pressure, suitable for 173 lbs. water pressure as specified for A.W.W.A. Class "D" Fittings.

*Write for Catalog 1, "Water Works Specialties".*

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Split Sleeve Fig. 522

Tee Fig. 511

Warren Coupling Fig. 533

Long ¼ Bend Fig. 505

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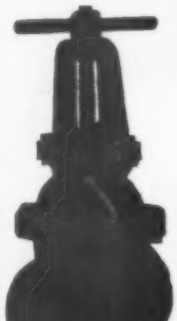
*Why are*

# RENSSELAER PRODUCTS

*so Popular?*



Let us send you our Bulletins X and W so you can see for yourself.

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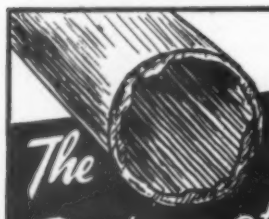

*The* **TATE** *Cement Lining Process*

*Restores efficiency of old Water Mains*

***Now*** **is the time to investigate the Tate Cement Lining process —and see what it can do to restore the efficiency of your old water mains.**

**View showing Tate Process in Pipe Joint. Note thoroughness of Lining.**

***Write for Literature.***

**What the TATE Process accomplishes**

1. **Water mains cleaned and cement-lined without removing pipe.**
2. **Eliminates discoloration and further cleaning costs.**
3. **Reduces pumping costs.**
4. **Restores reduction in head and flow co-efficients. This means full fire protection and lowered insurance rates.**
5. **All joints cement-lined . . . just one continuous pipe.**
6. **Does the job without interruption of service to consumer.**

TATE PIPE LININGS, Inc.
ANDOVER, MASS.


an "E" for its Tacoma plant), and the Cooper-Bessemer Corp., whose Maritime "M" flag is now adorned with five gold stars.

Each star signifies an additional six months' period in which the company has maintained its production at a level worthy of commendation by the Army and Navy signified by the original "E" or "M" awards.

## New Alum Plant for American Cyanamid

A new plant for the manufacture of commercial alum (sulphate of alumina) is being built by the American Cyanamid and Chemical Corp. on a forty-acre tract at Schenk, Ohio, just outside the city limits of Hamilton.

The Corporation, a unit of American Cyanamid Co., operates seven other plants for the manufacture of alum in widely separated locations.

## Atlas Dual Case

Made by the Atlas Welding Accessories Co., 14824 Wyoming Ave., Detroit 21, Mich., a new carrying case for welding electrodes has been designed to carry a supply of electrodes

at the welder's belt along with an Atlas Weld Cleaning Tool. This carrier prevents scrapping of electrodes due to cracked flux coating because it keeps them off the floor. Constructed out of heavy harness leather, riveted for permanence and having a capacity of 8 to 10 lb. of electrodes, it is expected that time will be saved by having the electrodes and chipping hammer at the welder's hand.

## LITERATURE AND CATALOGS

**Is Your P. F. T. Bulletin File Up-to-Date?** If you don't know write to Pacific Flush-Tank Co. for the folder so entitled and find the answer to this question. Among other things this little folder will tell you is that P. F. T. has been manufacturing sewage treatment equipment exclusively since 1893. And unless we're mistaken, this is a unique distinction amongst equipment manufacturers in this field.

Along with this folder in our mail came the following bulletins: No. 133—**The P. F. T. Sewage and Sludge Sampler,** "a convenient positive device for sampling still or flowing liquids, without disturbing the liquid bodies or contaminating the samples"; and No. 243—**P. F. T. Supernatant Selectors and Gauge Sight-Glass and Sampler for Sludge Digestion Tanks.** Also in the mail were reprints of two articles by Harry Schlenz of P. F. T.; one entitled "Controlled Digestion," in which among other things the still controversial subject of ammonium sulfate for scum control is discussed; the other is "Controlled Garbage Digestion."

Sometimes the "stuff" that advertising managers send out is a bit too, too, if you know what we mean. But when Clayton's Larry Huck wrote that "float valves have many applications in almost every industry and our recent circular, **Liquid Level Control Valves,** should be of considerable interest to many of your readers," we were inclined to agree.

Included in this Cat. No. Fv11 (145) are the Clayton Float Valves with "feather touch" pilot control, Angle Pattern Float Valves, Float Chamber Control, and Remote Float Control. The construction details as well as the operating sequences are shown, and it is stated that these valves are completely hydraulic in operation, available for any kind of tank, sump, or vat, easily adjusted for various levels, and that the tank can be supplied from either top or bottom.

If you write Clayton Mfg. Co., Alhambra, Cal., you might also ask about the No. 53 Clayton Relief or Back Pressure Valve, and the Clayton No-Slam Check Valve No. 81.

Maybe we have seen Fred Stuart's folder on the **Palmer Surface Wash System** before, but if so, we don't remember it. Fred admits it isn't a new release, but we thought there might be some others like ourselves who haven't seen it, so we asked for one. Aside from showing how the Palmer Surface Wash System works to eliminate mudballs, reduces wash water, eliminates cracking and shrinking, and increases capacity, the folder doesn't say much more except to list successful installation—but then, anything that does all that shouldn't have to have much more said about it. There is a technical publication No. 1044 entitled "Experiences with the Palmer Filter Bed Agitator at Olean, N. Y.," which comes along with the folder if you write to Stuart-Brumley Corp., 516 N. Charles St., Baltimore 1, Md.

Niagara Alkali's **"Pioneer"** has a front cover showing water in the orient, which must have been the reason we thumbed through it to find what else it contained concerning water and sewage treatment.


# Flexible Does The *IMPOSSIBLE* Again

**"IMPOSSIBLE!" SAID SIX ENGINEERS WHEN THEY SAW THE CONDITION OF THIS 33-YEAR-OLD SALT WATER PIPE LINE**

ONE LOOK at this salt water pipe line filled with a coral crustacean and a variety of tubipore marine growths would convince anyone that this pipe could not be made serviceable. For 33 years it lay untouched until its carrying capacity was restricted to 25% of its original.

Yes, Flexible cleaned the pipe line and restored its original water carrying capacity. The job was done at a fraction of the cost of replacing the pipe line and the new clean line will save thousands of dollars in pumping energy alone.

Flexible is justly proud of this job for they believe no other organization in America could have done the job as well or as fast. Have you a pipe line cleaning problem? Write us about it, today!

Size of coral slugs is indicated by yard stick. Were removed from 3,000 feet of 24-inch pipe line for one of America's largest oil refineries.

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**FLEXIBLE UNDERGROUND PIPE-CLEANING CO.**

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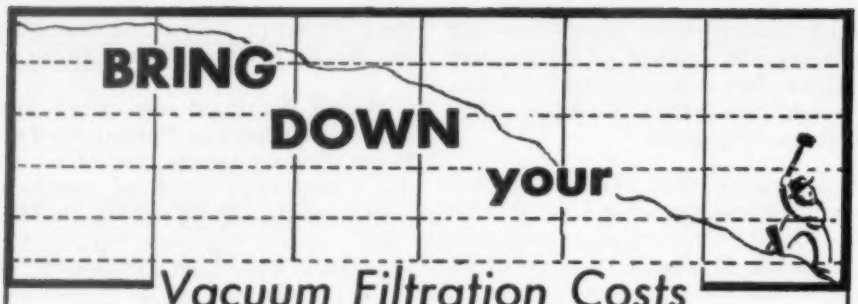


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Established 1816
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84" pipe—Spring Lake, N. J.

**FLANGED PIPE**

**FLEXIBLE JOINT PIPE**

**BELL & SPIGOT PIPE**

**SPECIAL CASTINGS**

**SHORT BODY BELL & SPIGOT SPECIALS**

***Large stock enables us to make prompt shipments.***

# CAST IRON PIPE

SIZES 2" TO 84"

## Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.


And there, on page four, is an item about H. P. Cortelyou, Engineer-Director of Los Angeles' Bureau of Maintenance and Sanitation. The item tells about the safety measures and devices Cortelyou uses for sewer inspections. On the same page is an item about how the New Brunswick Sewage Treatment plant solved a leaking sludge pump problem by using Sero packing. We've run into several persons who have tried that marine packing on sludge pumps with excellent results. This **Pioneer** has a lot of other interesting material in it besides a murder mystery each month and is published monthly by Niagara Alkali Co., 60 E. 42nd St., New York 17, N. Y.

We don't know why the June-July issue of **Builders Venturi News** should have appeared on our desk only recently, but we do know that its editor, one Charlie (Alfalfa Bill) Richardson, is a man with an eagle eye for a printer's error, so we were amused to note on page 10 that one of Builders Flo-watch Meter users had spotted an advt. for same in which the cut of the meter was upside down.

That particular item is included in a section devoted to *"Truth or Whimsy,"* which discusses such subjects as "How small is a cod before he's a scrod, or how big is a scrod before he's a cod?" This issue, No. 7 in Vol. VI, also contains an editorial column, "The Swivel Chair," and an article by "Rollie" Leveque on Omega's Gravimetric Feeder, along with "More About Clemens Herschel," and a column on Service Puzzles and Answers. This latter feature is devoted to proving that, while figures don't lie, meters can if they are not installed properly; as, for example, when in a Venturi tube both pressure lines are connected to the inlet ring.

Although no Aug.-Sept. issue was published, we're looking forward to the next issue and suggest, if you desire a copy, that you write to Builders-Providence, Inc., 9 Codding St., Providence, R. I.

We have just finished leafing through the 80 pages of revised edition of the **Duronze Manual** of Bridgeport Brass Co. and find on page 48 that "Duronze III is recommended for high strength castings, valve bodies and stems, . . . marine and builders hardware, gears, pinions, *equipment for sewage disposal plants, water purifying systems* . . . or for any purpose where a strong, dependable corrosion-resistant alloy is needed."

Now that isn't much space, out of an 80-page book, to tell about a product that can be and is used in a dozen or more places in water, sewage, and industrial waste plants where corrosion attack and wear indicate the need for a material that will insure continuous operation and low maintenance cost, but the book is packed with other technical information on these various alloys. Not only is Duronze III good in these places, but also Duronze IV may be used, the choice depending on the use.

Duronze III is an aluminum bronze modified by silicon, which is approximately 50 per cent stronger than brass and 9 per cent lighter in weight. An interesting table, one of many, is the comparison of Duronze III to Naval Brass, showing the relative sizes that give the same tensile and yield strengths.

Although this manual doesn't mention specific uses of Duronze in water and sewage plants, it is obvious that the alloys will find use in valve stems and parts for gate and globe valves, weirs, gates, filters, meters, walkways, baffles, troughs, chains, plates, bars, flights, and other miscellaneous uses. You can understand why, if you obtain a copy of the Duronze Manual from the Bridgeport Brass Co., Bridgeport 2, Conn.

The idea of reprinting digests of articles, as originated by *Readers' Digest*, has spread now to our manufacturers. Josam Mfg. Co. publishes a **News-Digest** in which are reprinted articles and editorials of interest from other business and trade papers and house organs. Included in the Jan. 1945 issue is an item from *Meat* on "Streamlined Set-up to Handle Salvage Fats," and another on "Army Engineers Use Bamboo for Water Pipe in Southwest China," reprinted from *Plumbing and Heating Business*. If you want to be on the News-Digest mailing list, write to Josam Mfg. Co., 350 Empire Bldg., Cleveland, Ohio.

Almost coincidental with the news that Wendell R. LaDue of Akron, Ohio, was nominated for Vice President of the AWWA came the January issue of **Cast Iron Pipe News**, in which Mr. LaDue has an article on the "Large Cast Iron Pipe Feeder Mains Laid to Supply War Industries at Akron." As Supt. and Chief Engr. of Akron's Bureau of Water and Sewerage, Wendell R. knows whereof he speaks when he says that although population has increased some 20 per cent since


# CEMENT GUN COMPANY
## "GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

### "GUNITE" SAVES FOUNDATIONS

The "before" and "after" photos show two of three water standpipe foundations which we restored last year for the Village of Carthage, N. Y.

These foundations were very seriously disintegrated and in dangerous condition. All loose and deteriorated concrete was chipped away and mesh reinforced "GUNITE" placed 3" to 12" thick to restore the foundations to original dimensions. Extreme care was taken to place "GUNITE" well under the bearing edge of the standpipe.

This work was done under the supervision of Mr. J. Lamprecht, Consulting Engineer, Fayetteville, N. Y.

**Our 74-page bulletin 2200 describes scores of uses of "GUNITE". Write for your copy.**

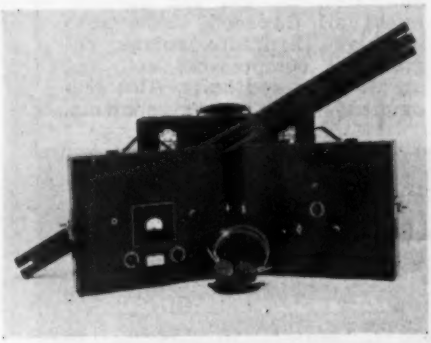
## MANUFACTURERS OF THE "CEMENT GUN"

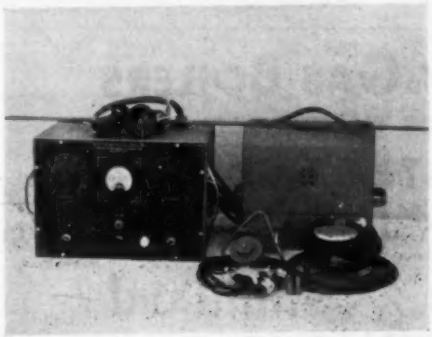
# M-SCOPE

**Pipe Finder**

**Leak Survey Equipment**

**Leak Detector**





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GLAZED FIRE CLAY TILE FILTER BOTTOM

*Non-Corrosive—Permanent*

DRY CHEMICAL FEEDERS

*Accurate—Dependable*

*also*

COMPLETE WATER TREATMENT EQUIPMENT

**F. B. LEOPOLD CO., INC.**

422 FIRST AVE. PITTSBURGH 19, PA.

**'BESTOLIFE**

LEAD SEAL
JOINT SEALING
AND ANTI-SEIZE
PIPE JOINT COMPOUNDS

'BESTOLIFE Compounds have been used successfully for years in Water Works and Sewerage plants.

They obtain their effective anti-corrosion sealing characteristics from the metallic lead base of the compounds.

Use 'BESTOLIFE Compounds on water, oil, gas and gasoline lines; all threaded connections in valves, hydrants, pumps, engines, air compressors, etc., and on all studs and bolts. Also recommended for meter repairing.

*Manufactured Exclusively By*

**I. H. GRANCELL**

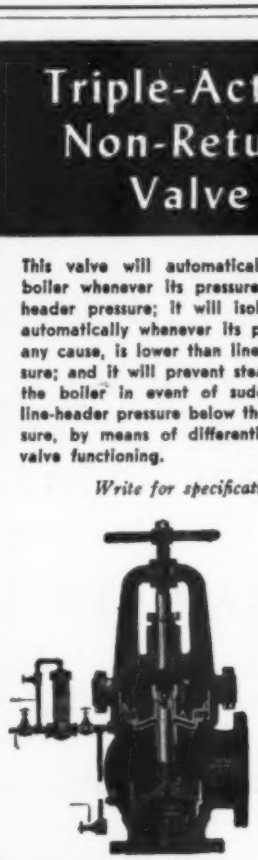
MIRAMONTE AND EAST NADEAU ST.
LOS ANGELES 1, CALIFORNIA

EXPORT: THE NATIONAL SUPPLY CORP.

**Triple-Acting Non-Return Valve**

This valve will automatically cut in a boiler whenever its pressure equals line-header pressure; it will isolate a boiler automatically whenever its pressure, from any cause, is lower than line-header pressure; and it will prevent steam flow from the boiler in event of sudden drop of line-header pressure below the boiler pressure, by means of differential shot pilot valve functioning.

*Write for specifications.*



Furnished in angle, globe and elbow patterns, sizes 2½" to 12"; also available in larger sizes, as well as in the Cross pattern.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

**AMERICAN GAS BOILERS**

STEAM AND WATER TYPES

FOR **DIGESTER HEATING**

*SEE DATA PAGE IN ANNUAL REFERENCE SECTION*

**AMERICAN RADIATOR & Standard Sanitary**

*New York* CORPORATION *Pittsburgh*

SALES OFFICES IN ALL PRINCIPAL CITIES


1940, the water consumption has increased 45 per cent. In the last four years the distribution system has increased by 24 miles, of which 19 miles has been in sizes of 20 to 36-in.

Since we learned that the subject of corrosion and protection against corrosion ranks near the top in the interest of our readers, we have been more keenly aware of articles, catalogs, equipment, coatings, and materials that have to do with this subject. You can well guess then that when we heard about the bulletin entitled **Corrosion**, published by the International Nickel Co., we wrote for it. This fifty page bulletin is really crammed with information of the fundamentals of corrosion and controlling factors. As might be expected, the book contains several tables showing the resistance of monel, nickel, and inconel to a large number of corrosive liquids and substances.

There is also much information on concentration cells, conversion factors, corrosion testing methods, galvanic corrosion, and units for use in expressing and reporting corrosion rates. While there is nothing in the bulletin on the direct use of these metals in water and sewage plants, there is no doubt that they do have such applications. We know of several sewage plants where monel screens are used on vacuum filters, and we believe too that there are several other places where these corrosion resistant metals should find application in a sewage plant. At any rate, plant chemists should be interested in this bulletin, which may be obtained by writing the International Nickel Co., 67 Wall St., New York 5, N. Y.

Does your wood or textiles suffer from rot, decay, mildew, and insects? Try **Quigley Triple-A Copper Naphthenate Preservative**! Although not couched in the language of the patent medicine nostrum, this is the theme of Bulletin No. 381 of the Quigley Co., Inc., 527 Fifth Ave., New York 17, N. Y. These wood and textile preservatives are anti-acid, anti-alkaline, and moisture protective. We know our readers are interested in protection against corrosion and we have an idea that many of them may also find this protection against wood and textile deterioration of interest.

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Several times in as many years we've heard about a soluble lignin derivative being used in cement, but we didn't know it was so versatile until Joe Wafer of Industrial Chemical Sales Div. of West Virginia Pulp and Paper Co. sent us a booklet entitled **Indulin—Lignin from Pine Wood.** From adhesives and absorbents to water treatment and wetting agents some twenty-two uses are listed with the various references in the literature to these uses.

Of particular interest to us, besides the application of Indulin in cements, is its use as a corrosion inhibitor in boiler water treatment in the removal of iron from water, and for water softening via resins ion exchanges prepared from lignin. This Bull. L-1 of the Development Dep't of Industrial Chemical Sales may be obtained from the company by writing to 230 Park Ave., New York 17, N. Y.

**Link-Belt News** doesn't always have something in it that pertains to water or sewage treatment equipment, but every month there is a picture of "Claire," whose delectable self has been a part of Link-Belt News since August, 1937. And now the L-B News Editor is asking if the readers would like to have Claire continue as a part of the News. If our memory serves us rightly, there was a time once when Claire's picture was omitted, and according to the succeeding issues, there was quite a howl set up for her return. We don't think the readers of Link-Belt's News have changed their thinking much since 1937. Certainly Claire hasn't—and, we'll bet she stays.

Ever since we first saw a new 16 page catalog entitled **Belden Acid-proof Brick Floors** we've been wondering if this material would have any application in water and sewage treatment plants. The catalog obtainable from the Belden Brick Co., Canton, Ohio, indicates that the bricks are not only acid-proof but are abrasion resistant as well and have a high resistance to temperature change and impact. These floors have been used in tanneries, packing houses, pickling rooms, breweries, distilleries, and elsewhere. Seems to us we remember this same kind of brick being used to line a cyclone in a sludge incinerator with excellent success, the brick being more resistant to the wear of sludge particles and fine grit than sheet steel.

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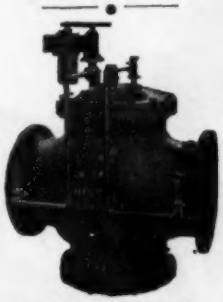

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In addition to the usual stories of personnel both on the job and overseas in service, a recent issue of the **Worthington Harrison Works News** contained an article on "Increased Efficiency Liquid Measurement Meter for Industrial Field" by Wm. L. Herron. Mr. Herron discusses the improvements in meter registration and comments on the change in nomenclature in connection with meter performance, making particular reference to the use of the term "accuracy range" to express the spread of per cent registration for a range of rates of flow. There are other comments of interest on meters and metering and specifications.

When Leeds and Northrup gather all of their instruments into one General Catalog featuring **"Modern Precision,"** you may rest assured that it makes a sizable and interesting bulletin to have around a power plant if you are a chemist, engineer, or operator. Illustrated by means of diagrams and installation photographs, this handy digest of L&N's more complete literature is divided into groups of instruments according to their application. These headings include "Elec-


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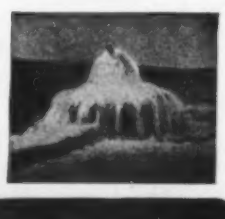

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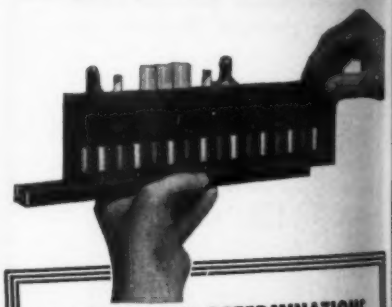

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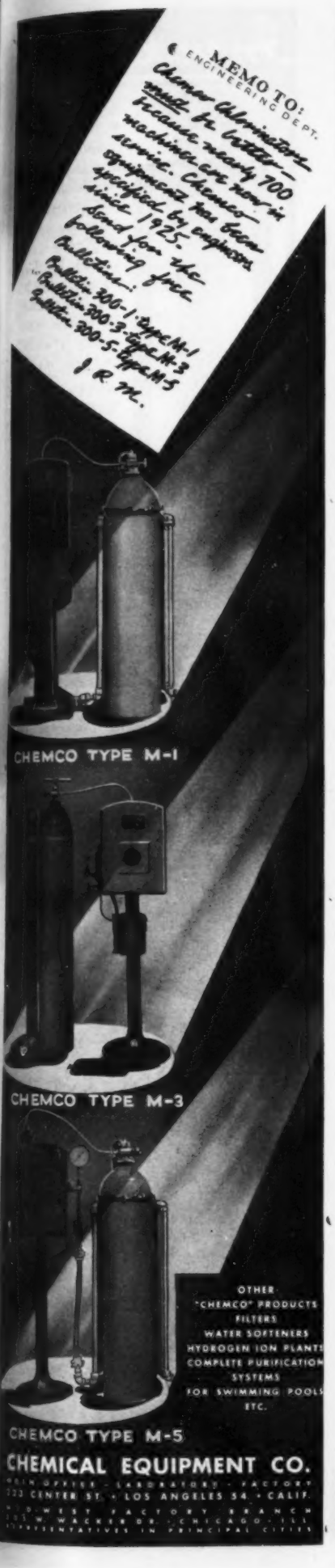
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Four other equipments are described in some detail: the Centrimax Flowmeter; Load-Frequency Control; a pneumatic-electric system; Type P Combustion Control.

Added to these are L&N laboratory instruments, heat treating furnaces, and equipments for regulating industrial processes. If you want a copy of this 28-page publication spend a penny for a postcard and be sure you address it to Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa. And specify **Folder ENT (7a).**

Roots-Connersville Blower Corp. of Connersville, Ind., has just issued a new four-page general bulletin, No. G-81-D, **Equipment for Handling Gas and Air,** covering its rotary positive blowers and gas pumps, centrifugal blowers and exhausters, rotary positive vacuum and liquid pumps, rotary displacement gas and liquid meters, and inert gas generators.

The new folder presents views of typical installations covering the principal applications, such as the chemical and process industries, water works and sewage treatment plants, metal working industries, gas plants and oil refineries, mining and smelting, and so forth. Copies of the new bulletin are available on request to the main office or any branch of Roots-Connersville Blower Corp., now one of the Dresser Industries.

There's nothing new under the sun. The goatskin water bag, which cools itself by the evaporation of the small amount of water seeping through, was known to the ancient desert Arabs, among others. Now comes the story of how science can do it better. Even prior to the present war, the Army used the principle of water-cooling bags. In the Dec. issue of the **Rohm & Haas Reporter** is an article on the new Rohm & Haas Rhoplex WC-9 and Primal C which makes cotton duck suitable for self-cooling containers. The new bag not only replaces the old goatskin but also the more recent but hard-to-get flax. If you are interested in a self-cooling water bag for that vacation trip or for a con-

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struction gang, ask Rohm & Haas for a copy of the Reporter. The address is Washington Square, Philadelphia 5, Pa.

A short time back we were put on the mailing list of the **Monthly Bulletin** of the Indiana State Board of Health, a bulletin edited by Thurman B. Rice, M.D., Acting State Health Commissioner, and his assistant editor, Charlotte Haseman. Thanks to Joe Quinn, we were able to obtain a set of back copies in which there ran a series of articles by members of the Indiana Stream Pollution Control Board. Dr. Rice wrote on the water and soil resources of the state; Joe, himself (the technical secretary of the board), says **"Abatement of Stream Pollution Is a Challenge,"** and he tells why in a couple of pages. Stream Pollution and Fish Life was the subject covered by Hugh A. Barnhart, Dir. of the Ind. Dept. of Conservation.

Cecil Calvert, Supt. of Purification of the Indianapolis Water Co. and a member of the Ind. Stream Pollution Control Board, writes on the Effect of Pollution on Water Treatment, as might well be expected, while Chas. M. Dawson, Lt. Gov. and Commissioner of Agriculture, has an article on the **"Effect of Pollution on Agricultural Pursuits."** If you want some ammunition for that speech you have to give before the local conservation club, write to Miss Haseman or Joe Quinn, Ind. Dept. of Health, 1098 Michigan Ave., Indianapolis, Ind., for the copies of the issues containing these articles. It will be worth your time and effort.


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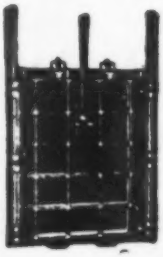

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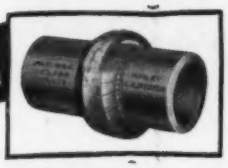

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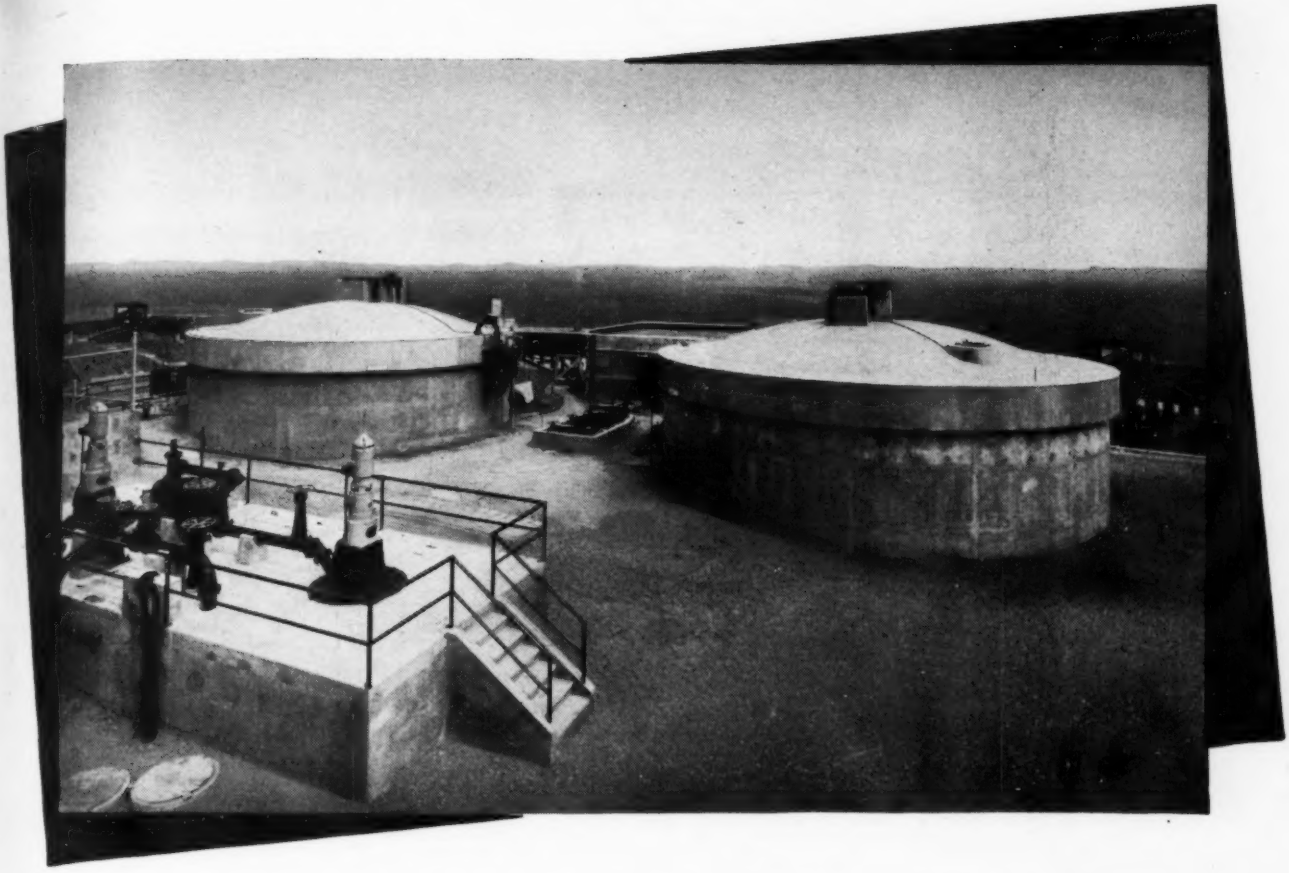

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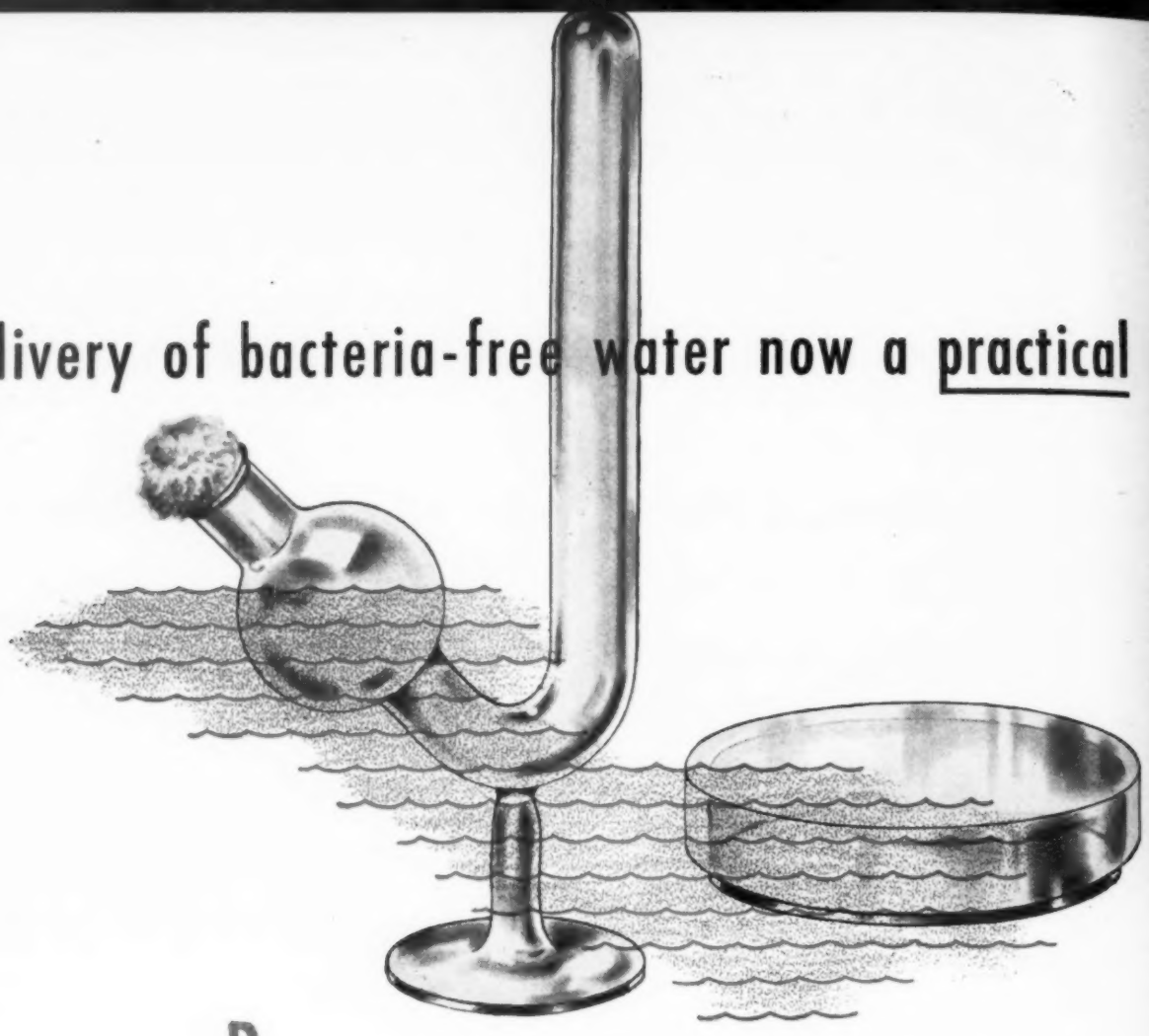

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